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NATIONAL WATERWAYS STUDY. TRAFFIC FORECASTING METHODOLOGY.(U)

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A unique, two-stage forecasting procedure was developed for the National Waterways Study waterbourne traffic analysis. The first stage examined the unconstrained (by modal or institutional factors) demands for future waterbourne transporation in the United States by forecasting the regional economic growth for those industries oriented toward waterway movement of goods. This report presents the results of the first stage analysis. The second stage of the forecasting procedure involved development of alternative scenarios about the growth of waterbourne traffic that included economic, energy, environmental, transportation, and public policy considerations. Four alternative futures were considered in the second-stage scenario analysis, in addition to three sensitivity analyses. The complete waterbourne traffic projections by scenario are contained in Appendix A to the NWS report, "Evaluation of the Present Navigation System."

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THIS REPORT IS PART OF THE NATIONAL WATERWAYS STUDY AUTHORIZED BY CONGRESS IN SECTION 158 OF THE WATER RESOURCES DEVELOPMENT ACT OF 1976 (PUBLIC LAW 94-587). THE STUDY WAS CONDUCTED BY THE US ARMY ENGINEER INSTITUTE FOR WATER RESOURCES FOR THE CHIEF OF ENGINEERS ACTING FOR THE SECRETARY OF THE ARMY.

NATIONAL WATERWAYS STUDY

TRAFFIC FORECASTING METHODOLOGY

PREFACE

This report is one of eleven technical reports provided to the Corps of Engineers in support of the National Waterways Study by A. T. Kearney, Inc. and its subcontractors. This set of reports contains all significant findings and conclusions from the contractor effort over more than two years.

A. T. Kearney, Inc. (Management Consultants) was the prime contractor to the Institute for Water Resources of the United States Army Corps of Engineers for the National Waterways Study. Kearney was supported by two subcontractors: Data Resources, Inc. (economics and forecasting) and Louis Berger & Associates (waterway and environmental engineering).

The purpose of the contractor effort has been to professionally and evenhandedly analyze potential alternative strategies for the management of the nation's waterways through the year 2000. The purpose of the National Waterways Study is to provide the basis for policy recommendations by the Secretary of the Army and for the formulation of national waterways policy by Congress.

This report forms part of the base of technical research conducted for this study. The primary purpose of this report was to develop a set of unconstrained waterways traffic demand projections under alternative macroeconomic forecasts over a 25 year period. The results of this analysis were reviewed at public meetings held throughout the country. Comments and suggestions from the public were incorporated.

This is deliverable under Contract DACW 72-79-C-0003. It represents the output to satisfy the requirements for the deliverable in the Statement of Work. This report constitutes the single requirement of this Project Element, completed by A. T. Kearney, Inc. and its primary subcontractors, Data Resources, Inc. and Louis Berger and Associates, Inc. The primary technical work on this report was the responsibility of Data Resources, Inc. This document supercedes all deliverable working papers. This report is the sole official deliverable available for use under this Project Element.

National Waterways Study

FINAL REPORT

TRAFFIC FORECASTING METHODOLOGY

UNITED STATES ARMY CORPS OF ENGINEERS

TRAFFIC FORECASTING METHODOLOGY AND DEMAND PROJECTIONS

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FOREWARD

A unique, two-stage forecasting procedure was developed for the National Waterways Study waterborne traffic analysis. The first stage examined the unconstrained (by modal or institutional factors) demands for future waterborne transportation in the United States by forecasting the regional economic growth for those industries oriented toward waterway movement of goods. For example, waterborne coal traffic on the Ohio River depended on the growth of coal use by electric utilities and industrial plants in the Ohio River Valley states to the year 2003. Thus, the underlying growth in waterborne commodity traffic depends only on macroeconomic alternatives, rather than transportation-related factors (such as modal competition). This report presents the results of the first stage analyses.

The second stage of the forecasting procedure involved development of alternative scenarios about the growth of waterborne traffic that included economic, energy, environmental, transportation, and public policy considerations. The major differences between the first and second stages are that other-than purely economic projections underlie the waterborne traffic forecasts and that a wide range of public opinion was solicited by the NWS study team on the final content of the scenarios. A typical modification to the first stage waterborne coal traffic forecasts by segment was the inclusion of proposed coal-based synthetic fuel plants that will be served by barge transportation. The waterborne coal projections were increased for relevant river segments to reflect the additional coal flows to the synfuel plants in the correct forecast years. In all, four alternative futures were considered in the second-stage scenario analysis; Baseline, High Water Transportation Use, Lower Water Transportation Use, and Bad Energy.

Three additional sensitivity analyses were also developed. The first examined potential United States defense requirements for waterway usage, projecting the impact of a limited, conventional war on waterborne traffic flows in the 1980s. A second scenario, reflecting the high United States export coal projections through the year 2000 put forth recently by the National Coal Association. A third, miscellaneous scenario contained certain historical and forecast waterborne data base corrections for the Ohio,

Monongahela, and Inner Harbor Canal (New Orleans) waterways as well as higher overall waterways traffic forecasts to the year 2003 for the Columbia/Snake and Arkansas Rivers based on Corps of Engineers estimates of potential new movements on these systems.

These sensitivities reflect additional information that became available after the major waterborne forecasts were complete, and were considered capable of influencing the final conclusions, thus warrenting additional traffic forecasts. Complete descriptions of the forecast assumptions by scenario as well as complete waterborne traffic projections by scenario are documented in the NWS report, "Waterborne Commodity Flow Projections" Appendix A to report, Evaluation of Present Waterways System.

Thus, the projections found in the current report are not NWS forecasts but only reflect the results of the first-stage analysis described above. Final NWS waterborne traffic projections by scenario are found in Appendix A of the report referenced above.

EXECUTIVE SUMMARY

FARM PRODUCTS

Foreign demand for United States farm products will grow 4.0% per year from 1977 to 1990 and 3.0% per year from 1990 to 2003, causing strong growth in domestic waterborne traffic demand. Led by corn, wheat, and soybeans, domestic farm products shipments will increase 3.0% per year through 2003 while ton-miles will grow 3.1% per year. The Mississippi, Illinois, Ohio and Columbia/Snake Rivers will continue to originate most tonnage; approximately 90% of the domestic traffic and all the projected growth will be in shipments bound for export. Southeastern States will grow an increasing share of United States soybean production as the Corn Belt states concentrate on growing corn, leading to especially strong growth on the Warrior River System; and the West Coast will ship around 10% of United States corn exports, the share it captured between 1977 and 1979 when West Coast unit-train service was expanded.

METALLIC ORES

Iron ore consumption is projected to increase by 83.4% (91 million tons) between 1977 and 2003, due to a 65.5% increase in raw steel production coupled with large scale development of direct reduced iron production in the United States in response to iron and steel scrap shortages in the late 1980s and 1990s. Differential rates of growth of steel production as well as furnace conversion rates lead to different rates of growth of ore consumption regions. For example, while steel production in the South grows at 2.2% per year between 1977 and 2003, iron ore requirements in that region grow by 4.1% per year.

Domestic waterborne ore traffic demand grows from 52.4 million tons in the strike-depressed year of 1977 to 98.1 million tons in 1990 (5% per year growth) and then to 137.4 million tons during the second half of the forecast period (2.6% per year). This growth is dominated by iron ore, which constitutes 95% of the tonnage and grows from 50 million tons in 1977 to 133.9 million tons in 2003. Domestic

non-ferrous ore flows grow by 1.6% per year to 1990 and 1.3% beyond, with growth rates depressed by continued increases in the concentration of ore imports.

Waterborne imports of metallic ores grow from 59.6 million tons in 1977 to 71.9 million tons in 1990 (1.5% per year), and to 100.5 million tons in 2003 (2.6% per year after 1990). Iron ore imports, which were buoyed by the strike in 1977, grow at 1.2% per year to 1990 (compared to 1.9% for non-ferrous ores) and 3.0% per year after 1990 (1.7% for non-ferrous).

In general, the demand for domestic waterborne metallic ore transportation is projected to grow somewhat faster than iron ore consumption because the stagnation of iron ore production in the South leads to increased imports and subsequent barge delivery to plants in that region. Similarly, the shut-down of ore production in the Northeast leads to some substitution of Lake Superior ore and Great Lakes transportation. Finally, the recovery of domestic mining in the Lake Superior region in the beginning of the projection period causes a rapid increse in Lakes transportation and a related fall-off of imports.

Relatively slow projected growth of iron-ore requirements in the Cincinnati area and non-ferrous ore imports, both of which stimulate the demand for inland barge movements out of Lower Mississippi River ports, leads to slower-than-average growth in metallic ores demand on the Mississippi and Ohio Rivers.

COAL

Waterborne tonnage of coal will continue to be a significant contribution to total waterborne tonnage throughout the forecast period. Total domestic demand for waterborne coal tonnage is expected to grow at an average annual rate of 4.5% from 1977 to 1990 and 3.2% from 1990 to 2003. Total waterborne export demand is expected to grow an average of 3.6% per year from 1977 to 1990 and 1.8% per year from 1990 to 2003 while total waterborne import demand, on the other hand, will grow an average of 5.4% per year from 1977 to 1990 (the majority of the increase was registered in 1978 when imports reached 2.95 milion tons) and 0.1% per year from 1990 to 2003. Demand for domestic waterborne coal

tonnage will more than double during the 26 years forecast period, increasing from 156.3 million tons in 1977 to 418.9 million tons in 2003.

Mississippi River segments will represent the key areas of significant growth for waterborne coal demand during the forecast period. Two factors which will combine to make this growth occur include the assumed location of three synthetic fuel plants on the Lower Mississippi River and five synthetic fuel plants on the Mississippi River - Baton Rouge to Gulf segment, as well as increased coal exports through the Baton Rouge to Gulf segment. In addition, significant growth will occur along the Middle Atlantic segment representative of the conversion of oil-burning utility plants to coal-burning. Although no major modal shifts are expected to occur from 1977 to 2003, coal slurry pipelines and a deregulated railroad network could offer new transportation choices to coal shippers and receivers. A continuing increase in demand for western coal will also offer more opportunities for an integrated rail-barge network. Demand for domestic waterborne coal tonnage as a percent of total demand will, however, remain almost constant from 1977 to 2003, decreasing from 22% in 1977 to 21% in 2003.

CRUDE PETROLEUM

By 2003 the demand for waterborne transportation of crude petroleum increases significantly over 1977 levels, with domestic waterborne movement demand at 176.3 million tons, 119% higher than in 1977, and import movements at 560.5 million tons, up 38%. Export traffic, with minimal tonnage in 1977, continues to decline. Increased Alaskan North Slope production (from .34 mmbd in 1977 to 1.6 mmbd by 1985, a 371% increase in production levels) results in increased flows of Alaskan crude to West Coast and Gulf Coast locations, and substantial displacement of imported crude petroleum flows to the West Coast for refinery operations. The Northern Tier pipeline is expected to be constructed and to have flows of .70 mmbd by 1985, rising to 1.0 mmbd for 1995-2003. The pipeline attracts substantial flows of both Alaskan and foreign crude petroleum. Continued displacement of domestic waterborne crude petroleum flows from the Gulf to the East Coast is expected to continue and to be complete by 1985. Domestic coastwise and internal flows are expected to continue to incrase, although internal flows other than those along the GIWW, deepwater

lower Mississippi ports, and some other internal southern segments are expected to remain relatively minor in magnitude. Major industry changes in the next 25 years are not expected. The petroleum industry will continue to drill deeper, to utilize more advanced exploration and reclamation techniques, and to drill in offshore waters, all to an increasing extent. Increased prices of crude petroleum reduces consumption of petroleum products, acts to conserve petroleum, and hasten development of alternative energy sources. Major modal changes, other than those associated with the Northern Tier pipeline are not expected. The relatively mature nature of the distribution system for crude petroleum has already lead to most opportunities for cost efficient pipeline transportation of crude petroleum to be developed. The LOOP (Louisiana Offshore Oil Port) and potentially the Texas Superport port facility expansion(s) act to increase the amount of crude petroleum imports to the Gulf Coast by reducing transportation costs to the Gulf. The existing infrastructure and investment in collection, distribution, transporatation, storage, and refinery facilities through the Gulf Coast in particular and to a lesser extent in other regions acts to retard major modal and regional shifts in industry distribution and logistics activity.

NONMETALLIC MINERALS

Although domestic nonmetallic mineral traffic will grow .8% per year between 1977 and 2003, traffic will fall on 17 of 22 segments. The Ohio River and Middle Atlantic Coast will lose the most tonnage as sand and gravel shipments on these segments decline. The only major growth area is the Great Lakes where shipments increase 36.7 million tons and receipts 37.2 million tons, primarily because of growth in limestone, sand and gravel traffic. Market shifts will reduce the waterborne share of sand and gravel and sulfur; increased dredging restrictions will strengthen the competitive position of land quarries, and the increase in recovered sulfur production coupled with the limited supply of Frasch sulfur will favor rail transportation. In foreign trade the major development will be a rapid decline in phosphate rock exports as a result of limits on production and increased domestic demand.

FOOD AND KINDRED PRODUCTS

The demand for domestic food and kindred products traffic will grow 3.2% per year from 1977 to 1990 and 1.9% per year from 1990 to 2003. Like farm products, most domestic food products traffic moves from producing regions down the Mississippi and its tributaries to Lower Mississippi ports for export. Growth in these shipments is concentrated in grain mill products and oils, particularly soybean meal and oil.

Other major domestic flows are coastwise shipments of a variety of other food products to and from Hawaii and the Caribbean. Exports of food and kindred products, predominantly grain mill products, grow 3.5% per year to 1990 and 1.7% per year from 1990 to 2003; imports, dominated by the "other" component, grow 3.9% per year from 1977 to 2003. Deregulation of the railroad industry may increase the rail share of domestic food products traffic if railroads decide to set grain mill product rates closer to volume grain rates, but this depends on rail marketing strategy and the outcome is in doubt.

LUMBER AND WOOD PRODUCTS

The majority of waterborne lumber and wood products tonnage has historically been concentrated in the Pacific Northwest on the Washington/Oregon Coast, the Columbia-Snake-Willamette River system and the Alaskan Coast. The movement of rafted logs accounts for the majority of domestic shipments and receipts on these three segments, while exports from the Pacific Northwest account for another significant portion of total lumber and wood products flows. Demand for total waterborne traffic by the lumber and wood products industry is expected to average annual rates of growth of only 0.1% from 1977 to 2003, largely the result of a sharp decline in log exports during the 26 year period. Total waterborne exports accounted for 43% of total flows in 1977 but are expected to contribute only 30% to total flows in 2003. Exports will decline at an average annual rate of -1.6% from 1977 to 1990 and -0.8 from 1990 to 2003. Demand for domestic waterborne traffic by the lumber and wood products industry, however, is expected to grow at average annual rates of growth of 1.7% from 1977 to 1990 and 0.3% from 1990 to 2003.

A shift to an increased reliance on southern timber as opposed to Pacific Northwest timber by the lumber and wood products industry will be the major industry development during the forecast period. Although motor carriers will be the primary mode to benefit from the West to South shift in resources, the southern waterways should experience some increases in demand for traffic, especially for exporting. This is reflected in the strong average annual growth rates for exports out of Gulf Coast and East Coast ports (an average of 5.3% from 1977 to 1990 and 0.8% from 1990 to 2003) as opposed to the negative average annual growth rates seen on the West Coast (an average of -2.5% from 1977 to 1990 and -1.2% from 1990 to 2003).

PULP, PAPER AND ALLIED PRODUCTS

Waterborne flows of pulp, paper and allied products have historically, been an insignificant portion of total waterborne tonnage. In 1977, only 11.75 million tons originated or terminated on the United States waterway network. This figure is expected to increase to 13.94 million tons in 1990 and 15.71 million tons in 2003. These figures translate into average annual waterborne demand growth rates of 1.3% from 1977 to 1990 and 0.9% from 1990 to 2003. Export tonnage, which accounted for 43% of total pulp, paper and allied products waterborne tonnage in 1977, will experience increases in demand on average, of 2.2% per year from 1977 to 1990 and 1.4% from 1990 to 2003. Imports, on the other hand, will experience average annual declines in demand of -1.6% from 1977 to 1990 and -1.1% from 1990 to 2003. Import waterborne tonnage accounted for 23% of total pulp, paper and allied products tonnage in 1977.

Although the pulp, paper and allied products industry will have more difficulty moving to the South than the lumber and wood products industry, there will be a significant increase in production capacity for pulp, paper and allied products in the South during the forecast period. This increase in capacity will in turn, offer more opportunities for domestic waterborne traffic simply because more waterways exist in the South than in the Pacific Northwest. Despite these factors, demand for domestic waterborne transportation as a percent of total demand for waterborne transportation by the pulp, paper and allied products industry

will only reach 37%. This figure could increase significantly, however, as a result of increased truck and/or rail rates.

CHEMICALS

By 2003, the demand for domestic waterborne transportation of chemicals rises steadily to 230% of 1977 traffic levels, up to 105.9 million tons from 46.1 million tons in 1977. Imports trend upwards to approximately 167% of 1977 levels, up to 18.1 million tons for 2003, from 10.9 million tons in 1977. Exports in 2003 are 125% of 1977 levels, at 26.0 million tons for 2003, compared to 20.8 million tons in 1977, after peaking in 1985 at 32.7 million tons before declining gradually to 2003. Total traffic reflects the combined impacts of increasing demands for imports, exports, and domestic traffic, with 2003 levels at 193% of 1977 traffic, up to 15.0 million tons for 2003, from 77.8 million tons in 1977.

Key components of the overall growth in chemicals traffic include rapidly increasing domestic consumption of urea and nitrogen solutions for fertilizer use, with less rapid increases in DAP and concentrated superphosphate fertilizers, rapidly increasing exports of phosphate-containing fertilizers to 1985, followed by gradual declines, and gradual, steady growth in imported tonnages. Industrial chemicals generally exhibit upward trends ranging from 2.5% per year to 4.6% per year for a broad mix of chemicals for domestic traffic. Exports of industrial chemicals peak in 1980, due to controlled United States petroleum prices, and decline to 1990, before returning to their long term growth paths in the 1990s. Imports of industrial chemicals decline in 1980, and pick up in 1985 and 1990, returning to long term growth paths through the 1990's to 2003.

Key segments exhibiting significant shifts in traffic over time include the Ohio, Tennessee , and Upper Lower Mississippi segments for domestic industrial chemicals, which increase through 1985 to 2000 due to relocation of a moderate amount of industry capacity to secure access to coal for inexpensive fuel and power uses, and also for raw material uses as a direct or indirect source of petrochemical feedstocks and raw materials, without need for intermediate

transportation of coal to the Gulf Coast. Substantial amounts of coal based chemical facilities are also expected to be built along the GIWW and lower reaches of the Mississippi River. Terminations are less affected than originations by this shift in industry location due to southern and western segments than in the industrial Midwest, resulting from regional demand changes and differing rates of regional Atlantic and Middle Atlantic Segments exhibit the largest declines in total petroleum product traffic, reflecting declining demands, while South Atlantic traffic trends are flat to slightly negative. Gulf Coast to East Coast flows are reduced by completion of Colonial pipeline system expansions in 1981. Internal traffic generally exhibts flat to 1% per year traffic increases, with growth higher in the the downstream derivative processing plants, which would use the coal based intermediates as inputs, remaining in their current locations. East Coast and West Coast traffic levels are adversely impacted by environmental considerations affecting industry location, and fail to exhibit the traffic increases exhibited in internal traffic and along the Gulf Coast. Fertilizer shipments to the Corn Belt, (Illinois, Ohio, Upper Mississippi segments) show substantial gains of 50% to 100% from 1977 to 2003, with the traffic primarily coming from the Baton Rouge-Gulf, Gulf Coast East, and Gulf Coast West segments. Major industry and modal changes are not expected in the forecast period. Water will gain share slightly over rail as an increasing fraction of industry capacity is located on the water and in world scale size plants. Industry shifts are mostly related to process technology and feedstock shifts as the chemical industry learns to use coal based feedstocks and heavy gas/oil petroleum cuts rather than today's reliance on natural gas, naphthas, and light petroleum cuts.

PETROLEUM AND COAL PRODUCTS

By 2003, the demand for waterborne transportation of petroleum and coal products, primarily consisting of petroleum products, will be at close to 1977 levels for domestic traffic, and will exhibit declines for imports of residual fuel and "Other" petroleum products, while imports of other products (jet fuel, kerosine, distillates, gasoline) remain at 1977 levels, to achieve a net 27% reduction in total petroleum product imports by 2003 from 1977 levels. Exports, already minimal in 1977, decline further throughout the forecast period as the nation conserves its petroleum

for internal use. Substantial shifts in relative mix of petroleum products occur in the forecast period. Gasoline and residual fuel demands decline over time while distillate fuel, jet fuel and kerosine, and "Other" petroleum product demands increase over time. Gasoline's share of domestic product shipments declines to 21% by 2003 from 26% in 1977, while residual fuel shipments decline to 26% by 2003 from 36% in 1977. Jet fuel and kerosine increase to 7% of shipments by 2003 from a 1977 share of 5%, while distillate fuels increase share to 32% by 2003 on a 1977 share of 25%, and "Other" petroleum products increase share to 14% by 2003 on a 1977 share of 8%. Total domestic traffic over this time stayed relatively flat at from 364 million tons to 367 million tons. Key segments exhibit significant changes in traffic pattern. North growth. West Coast traffic exhibits mixed trends by time period and segment. Major industry shifts are not expected to be significant. Oil Producing Export Country price trajectories will adversely impact petroleum demands and hasten adoption of alternative energy sources. Some modal changes will occur across the forecast period. Those petroleum products that are nonpipeable will continue to move primarily via water for short, medium and long haul movements. Competition by pipeline operators for transportation of pipeable petroleum products, either increases in pipeline transmission capacity or attempts to maintain pipeline traffic at capacity in the face of slow growth to declining demands for pipeable product transportation at the expense of waterborne transportation will adversely affect the levels of waterborne transportation of products. Compounding this are the frequent financial relationships between pipeline operators and major petroleum refiners and marketers, which induces shippers to utilize pipeline transportation to recover a return on their fixed pipeline investments. Major new pipeline systems are considered unlikely, although stublines, looping of pipe, relaying of some pipe with larger diameter pipe, new terminals and pump stations, and installation of higher horse-powerage pumps will act to increase pipeline transmission capacity.

STONE, CLAY, GLASS AND CONCRETE PRODUCTS

Total domestic waterborne flows in stone, clay, glass and concrete products are expected to grow from about 12 million tons in 1977 to over 25 million tons by the year 2003. Through 1990, demand will increase by a compound annual rate of 4.0%, with the rate declining to 2.1% through

2003. The majority of domestic waterborne tonnage growth in this commodity is due to increased cement movements. The Atlantic Coast ports experience a strong growth in coastwise flows of cement as imports are distributed to final consumers. Total cement and other stone, clay and glass product imports are expected to grow from 3.9 million tons in 1977 to 5.5 million by the year 2003. For the inland system, the Ohio River, Gulf Coast Waterways, and the Lower Mississippi River are the segments likely to have the most rapid growth in stone, clay, glass and concrete products over the next 25 years. The only major market change expected in this commodity is the increase in long-haul cement traffic on the Mississippi and Ohio River Systems. The key industry change during the forecast period is the inability to easily relocate cement plants (due to environmental restrictions) nearer changing demand sites and the resultant potential growth in waterways cement traffic.

PRIMARY METALS PRODUCTS

Steel consumption in the United States will increase by 77.2 million short tons (71%) between 1977 and 2003 - a compound annual rate of just over 2.0%. The import share will settle at long term levels of ground 15% by the end of the period, but not before a temporary peak in the mid-1980s. The funds for the domestic capacity expansion required to meet these projections are assumed to be forthcoming from favorable tax law changes and a modest improvement in the price-cost relationship for domestic steel.

The demand for domestic waterborne transportation of primary metals grows more slowly than steel consumption (1.6%-1.7% per year), both because steel imports, which account for a disproportionate share of domestic barge steel transportation activity, lose market share from high 1977 levels and because intrasegment steel flows are expected to continue stagnating.

Primary metal imports grow somewhat faster than domestic waterborne traffic demand over the early forecast period due to a surge in coke imports in the late 1970s and early 1980s and strength in "other" primary metals imports including ferroalloys and non-ferrous metals. Thus, while iron and steel imports increase by only 1.4% per year from

1977 to 1990, "other" primary metals grow by 5.4% per year, and coke imports increase from 2.1 million tons to 6.6 million tons.

Although the modest market share loss of steel imports encourages relatively faster growth in waterborne transportation demand out of the northern producing areas, the strong growth of ferroalloy and other import-related primary metals traffic out of the Gulf preserves the major role of Lower Mississippi River ports in originating waterborne primary metals shipments.

WASTE AND SCRAP

Domestic waterborne waste and scrap transportation is flat from 1977 to 1990 and actually declines slightly from 14.3 million tons in 1990 to 13.9 million tons in 2003. This reflects growth in waterborne metal scrap demand of 3.1% per year between 1977 and 1990 and .4% thereafter, offset by slow declines in "other" scrap demand (-.3% to -.7% per year). Metal scrap demand is driven by growth in scrap requirements at water served iron and steel plants as well as scrap export activity, both of which are strong in the early 1980s, but flatten out thereafter under the influence of scrap shortages and increased use of sponge iron as a steel furnace feed. Declines in "other" scrap reflect continued restrictions on garbage and sludge dumping in the face of environmental pressures.

OTHER COMMODITIES

Domestic waterborne traffic flows of "other commodities" are expected to grow at a substantially lower rate than foreign trade in these commodities over the forecast period. Domestic flows, led basically by manufactured products are likely to increase by just under 2% per year from 1977 to 2003, while imports of "other commodities" (also paced by miscellaneous manufacturers) are forecast to grow at 3.8% per year and exports at 5.7%. Within domestic trades, coastwise flows of manufactured commodities - closely experience the strongest growth to 2003. All three coasts - Atlantic, Gulf, and Pacific - have similar foreign and coastwise trade growth rates in these commodities over the next twenty-five years. Miscellaneous manufacturers growth results in large traffic increases in domestic flows

along the Gulf Coast West, in line with recent experience in the region. The major market shift in "other commodities" during the forecast period is the growth in foreign trade activity. On a relative basis, the largest increases in "other commodity" foreign trade tonnage occurs on the East and West Coasts of the United States. Any forecasts risk are associated with United States foreign trade policy and the ability of the United States to control oil imports in the next decade, favoring improved balance of trade as well as trade growth in the forecast period.

I-INTRODUCTION

OBJECTIVE

The primary purpose of the National Waterway Study commodity flow analysis was to develop a set of unconstrained waterways traffic demand projections under alternative macroeconomic forecasts over the next 25 years. Unconstrained projections represent an estimate of potential waterways traffic as determined by growth or decline in economic markets and subject to no physical transportation constraints over time.

The term unconstrained projections as related to waterways traffic refers only to transportation-related capacity restrictions that may impact future waterborne shipments. This phase of the National Waterways Study sought to address the range of feasible waterborne traffic flows, assuming no waterways lock, or other channel, terminal, port, constraints hindered growth. Of course, the economic capacity of United States industries constrains the total traffic forecasts. The overall investment potential of the economy is limited by the growth in potential labor force, productivity and technology, among other factors. Thus, the forecasts presented in the following chapters do reflect estimates of the effect of future economic capacities by industry on water-related shipments, but do not explicitly restrict any movement due to a perceived waterborne transportation constraint.

In particular, waterborne traffic is estimated to increase or decrease in line with industries using waterways to ship all or part of their inputs and/or outputs. Regional shifts in production can also affect levels of waterborne traffic over time. Further, physical capacity constraints are assumed to be non-binding for all modes in the analysis. Rail terminal restrictions, export port congestion, and limited throughput at a waterway locks are all documented but held in reserve for later analysis. The objective is to determine what traffic would use the United States waterways system in the future given a lack of capacity - limiting constraints on the existing system.

Such an estimate clearly represents an upper economic bound on total waterways traffic, one that will likely never be reached. Of course, increasing all lock sizes and waterway depths would result in a higher, physically unconstrained system usage. However, a national study is obliged to look at a wide range of possible traffic projections in order to plan fully for an uncertain future. In an effort to include a detailed analysis of how economic growth in the United States will affect waterways transportation without assuming either rail or barge capacity constraints, the unconstrained traffic projection approach was developed. The objective of National Waterway Study is to identify and analyze alternative strategies for providing a navigation system to serve the nation's current and projected transportation needs. A primary output of Element B is a set of three demand projections based on alternative macroeconomic outlooks of the performance of the United States economy over the next 25 years.

The three demand projections are inputs to ten National Waterway Study traffic scenarios which also vary such alternate states of the world as transportation regulation, environmental restrictions, and other policy considerations, as well as industry-specific sensitivity factors. For example, one alternative forecast examines the collective effect of a set of governmental policies that are least favorable to waterways development over the next 25 years. These forecasts will encompass a set of alternative futures that policy-makers can use to plan for a wide variety of potential events, rather than just changing macroeconomic conditions. The evaluation stage of National Waterway Study uses the prior technical work - forecasts of potential future use of waterways and estimates of waterway capability - to analyze needs by comparing forecasts of use with waterways capability. In addition, alternative strategies to meet these needs are identified and evaluated.

FORECASTING METHODOLOGY

The National Waterway Study commodity flow forecasting methodology has been designed to provide consistent national and regional waterborne traffic projections to the year 2003. Figure I-1 describes the overall forecasting work flow.

First, a macroeconomic model of the United States Economy was used to generate three alternative macroeconomic forecasts of the United States economic performance over the next 25 years. The basic forecast (TRENDLONG2003A) estimates that the United States economy grows at its potential level of output (relative to labor force growth) in the forecast period. The first alternative, LARGERGOVT2003A, estimates that the government participation in the economy increases in the forecast period, implying lower overall growth rates. The second alternative, BADENERGY2003A, estimates that the price of imported oil rises 1.5% faster per year than in the basic forecast.

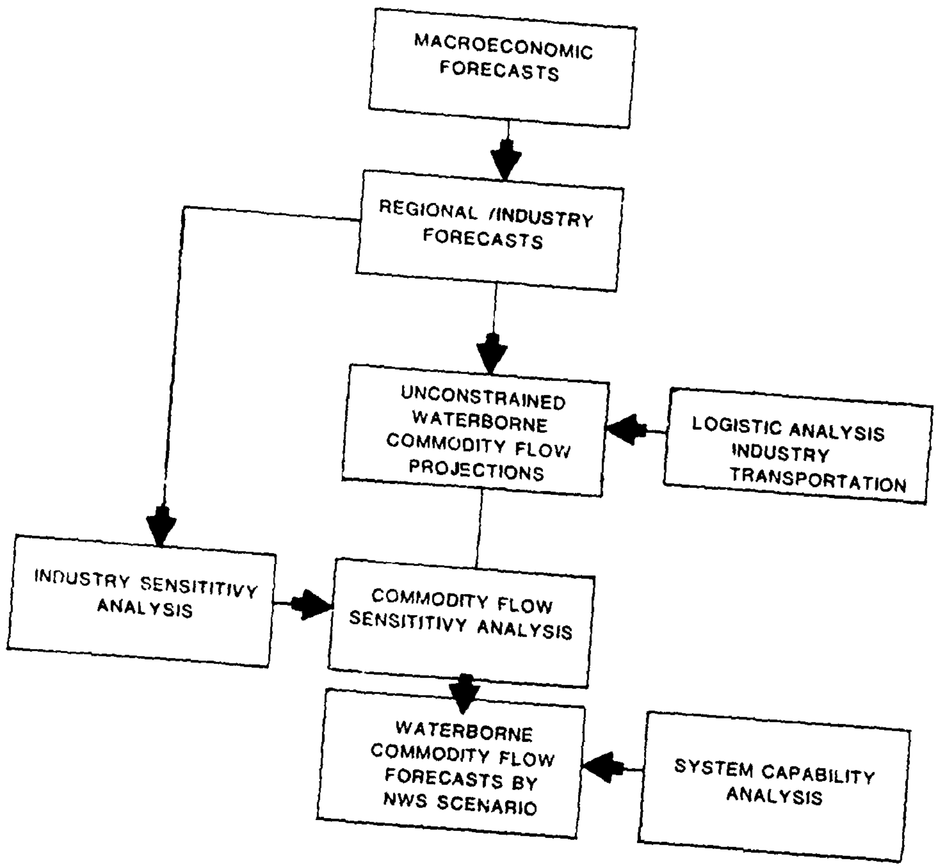
Industry models (agriculture, fertilizer, energy, coal, chemicals, steel, and forest products) then used the three macroeconomic forecasts to generate national and regional forecasts of major waterborne commodity groups. Regionality varied by industry, with agriculture forecasts at the crop producing region, energy and coal at the census region level, steel at the AISI production region, chemicals at the Gulf Coast versus other region level and forest products at the state level. The industry projections considered both prodction and consumption shifts by commodity and region as well as new market developments (for example, synfuels production or new export markets) over time. Finally, sensitivities of forecasts to key parameter changes (for example, United States grain export prices) were developed for additional scenario analysis later in the study.

The transportation analysts conducted an in-depth study of the major waterborne distribution systems, including the role of waterways in the logistic processes of major United States industries, alternative transportation modes available and prospective changes in the process over time. Institutional factors such as environmental concerns, new technology or modal economics changes that may influence future logistics strategies are also examined.

In the next stage, the regional industry production/consumption forecasts are coupled with the logistics analysis of water-served industries to produce waterborne demand projections by commodity and river segment. In general, historical waterways traffic flows by segment were related to industry demand for production in regions bordering the waterway. For example, Upper Mississippi River

FIGURE 1-1

NATIONAL WATERWAYS STUDY
ELEMENT B WORK FLOW



waterborne coal traffic market shares of East North Central and West North Central regions coal consumption was developed. Next, specific market share changes by segment were examined, due both to modal shifts within the regions or production/end-use shifts among the regions, for the forecast period. In the Upper Mississippi waterborne coal case, future waterway market share was reduced because new coal capacity at utilities is scheduled to be located off the river. Finally, any new flows were added, such as the movements from a new coal terminal in Iowa on the Upper Mississippi after 1985.

Next, two procedures are used to develop the six National Waterways Study scenarios. First, flows on individual river segments by commodity can be modified to reflect possible future events impact on waterways. As an example, grain movements originating on the Illinois Waterway can be adjusted to reflect the impacts of rail rate deregulation. Second, the industry sensitivity analysis can be used to test the effect of changing economic conditions on waterborne commodity flows. The impacts of allowing higher levels of steel imports (much of which moves by water) can be evaluated in the forecast period. Similarly, effects of a nuclear moritorium for new utility plants on waterways coal traffic can be studied.

The National Waterways Study team, along with substantial input from public agencies and private sources, has produced a set of most likely alternative futures for United States waterborne traffic through the year 2003. These scenarios reflect possible events that could impact the level and distribution of waterborne shipments by commodity over time. Higher levels of coal or grain exports, shifts in preferred export locations due to changes in modal transportation rates, and a bleaker energy future (involving higher fuel prices and faster conversion to petroleum-alternative energy sources) are all considered in the analysis. The results are summarized in the final report for the evaluation and strategy stage of the National Waterways Study.

Finally, in the evaluation stage of the National Waterways Study, the projected waterborne demand forecasts are compared to system capabilities - measured as lock capacity by river segment - in order to determine which

waterways may reach design throughput limits during the forecast period.

UNITED STATES ECONOMY FORECASTS

The three macroeconomic projections are based on the following judgements.

TRENDLONG2003A (baseline): estimates that the economy returns to its balanced growth path by the mid-1980s, in the context of moderating inflation.

LARGERGOVT2003A (first alternative): postulates a significantly larger government share in total economic activity. Total government spending rises from 32.3% of gross national product in 1981 to 36.2% in 2003, compared to a constant share in the baseline scenario.

BADENERGY2003A (second alternative): estimates higher imported crude oil prices during the forecast period. From 1981 to 2003, the price of imported oil is assumed to rise at a rate of 1.5 percentage points faster per year, so that imported prices are 36.3% above the baseline by 2003.

Table I-1 details the growth rates for major model forecasts to the year 2003 for the baseline TRENDLONG2003A scenario. The overall outlook is for a continued reduction in the potential level of real gross national product in the forecast period, due primarily to a slowdown in the civilian labor force growth and only moderate improvements in productivity per worker. Imported fuel prices continue to increase at a rate exceeding 8% per year through 1995. Conservation and higher prices lead to a slowing of the growth rate of imported oil from 3.8% in the 1980 to 1985 period down to just over 2% near the end of the century.

Government expenditures are assumed to remain at approximately the same share of gross national product through the year 2003. The implication is that significant new program initiatives are funded at the expense of existing programs or out of growth in tax revenues.

United States foreign trade is expected to return to a favorable balance (to the United States) by the mid-1980s, assuming the United States is capable of controlling oil imports growth. Production of major grains outside the United States is expected to expand at historical rates, although the impact on United States exports of farm products will be small (due to the comparative cost advantages of United States agriculture over the next 25 years).

Table I-2 contains the macroeconomic growth rates associated with the increasing public sector growth scenario, LARGERGOVT2003A. The major change is the rapid growth in government expenditures as a percent of gross national product. Such growth may be the result of crash synthetic fuels development programs in the 1980s or increased defense/public welfare funding.

The most visible impact is the further lowering of the growth rate in potential gross national product over the forecast period. Since consumption and investment funds are withdrawn from the private sector, real growth is lower since federal funds often end up as being transfers among groups in society.

This projection will be used in the scenarios related to expanded federal involvement in the waterways system.

Table I-3 summarizes the growth rates for key macroeconomic variables under the assumption of substantially higher prices for imported oil. Instead of the baseline assumption related to energy price increases, real imported energy prices are assumed to rise by another 1.5% per year over baseline. The impacts are most obvious in the decline in the rate of growth of fuel imports as well as fuel substitution effects within the energy sector (especially coal and nuclear power for oil).

The higher imported energy prices contribute significantly to inflation during the forecast period. The implicit price deflator for gross national product is up over 7% in 2003 relative to the baseline forecast and real wages decline over the period at a rate 2% faster than under TRENDLONG2003A.

Table 1-1

National Waterway Study

Data Resources, Inc.
Macro Model of the U.S. Economy

Key Model Forecasts
Growth Rates to 2003

Scenario-TRENDLONG2003A

	Compound Annual Percent Change				
	79 to 80	80 to 85	85 to 90	90 to 95	95 to 2003
Demographics and Labor Force					
Total Population, inc. Armed Forces Overseas	0.87	0.95	0.89	0.74	0.58
Population: age 18 to 64	1.48	1.14	0.77	0.54	0.90
Total Employment	1.17	2.06	1.34	0.94	0.96
Civilian Labor Force	1.71	1.77	1.28	0.93	0.99
Real Economy (1972 Dollars)					
Potential (Full Employment) Level of Real GNP	3.00	2.99	2.95	2.65	2.48
Gross National Product	2.31	3.52	3.02	2.63	2.45
Industrial Production Index-Total	1.65	4.96	3.63	3.26	3.44
Gross Private Domestic Investment	1.96	4.40	2.42	1.74	2.19
Plant & Equipment Expenditures-Railroads	-1.37	5.06	3.20	2.41	2.84
Plant & Equipment Expenditures-Other Transportation	-3.35	4.51	4.20	2.29	2.55
Real Personal Consumption Expenditures	1.96	3.70	3.11	2.32	2.60
Farm Proprietors Income	0.56	3.72	4.92	5.05	6.38
Energy/Environment					
Imports-Fuels & Lubricants	6.36	3.30	1.92	2.13	2.20
Unit Value Price of U.S Imports-Fuels	13.91	10.26	9.00	8.07	8.00
Unit Value Price of U.S. Imports-Fuels-Exogenized Value	13.91	10.26	9.00	8.07	8.00
Implicit Price Deflator-Fuels	6.90	6.33	6.42	6.16	6.00
Real Personal Consumption Expenditures-Fuels	2.55	2.96	2.39	2.31	1.89
Wholesale Price Index-Fuels & Lubricants	15.49	10.48	8.44	7.66	7.30
Pollution Abatement Expenditures by U.S. Business	19.80	11.22	9.73	7.89	7.42
Gross Capital Stock-Pollution Abatement Equipment	9.36	6.27	6.27	4.92	3.72
Prices					
Implicit Price Deflator-GNP	7.92	7.21	5.78	5.52	5.26
Implicit Price Deflator-Gross Fixed Private Investment	8.02	7.21	6.00	5.54	5.21
Index of Unit Labor Costs-Non Farm Business	7.57	7.06	5.97	5.90	5.75
Consumer Price Index	7.77	7.27	6.05	5.81	5.60
Government					
Federal Government Expenditures	11.15	10.15	8.53	8.12	7.73
State & Local Government Expenditures	11.31	10.83	9.38	8.88	6.19
Government Expenditures as a % of GNP	0.73	-0.61	-0.04	0.13	0.08
Foreign Trade/Economic Activity					
Exports of Goods & Services	3.53	5.41	4.53	4.61	4.76
Imports of Goods & Services	2.03	5.16	4.42	4.35	4.53
Industrial Production Index-Canada	5.65	4.99	4.50	4.44	4.32
Industrial Production Index-Japan	5.98	5.97	6.03	5.91	5.65
Industrial Production Index-OECD Countries	3.40	4.28	4.01	3.99	4.00
Composite Price Index-Major U.S. Trading Partners	7.08	7.28	6.49	6.07	6.07
Exchange Rate Index for U.S. Dollars	0.32	-0.54	-0.24	0.01	0.05
Production of Major Grains Outside the U.S.	2.10	2.09	2.10	2.10	2.10
Financial Markets					
Gross Public Debt Securities	5.01	2.12	0.02	0.43	1.57
Standard & Poors Index of Daily Stock Prices	7.25	5.92	9.44	8.15	7.02
Money Supply-Total	5.54	5.13	5.81	[illegible]	4.68
Average Yield-New Issues of Corporate Bonds	-2.13	0.05	-2.23	-0.79	-0.24
Average Market Yield-U.S. Govt 20 Year Bonds	-1.13	0.41	-2.36	-0.77	-0.02

Table 1-2

National Waterway Study

Data Resources, Inc.
Macro Model of the U.S. Economy

Key Model Forecasts
Growth Rates to 2003

Scenario-LARGERGOVT2003A

			Compound Annual Percent Change		
	79 to 80	80 to 85	85 to 90	90 to 95	95 to 2003
Demographics and Labor Force					
Total Population, inc. Armed Forces Overseas	0.37	0.95	0.39	0.74	0.58
Population: age 18 to 64	1.48	1.14	0.77	0.64	0.90
Total Employment	1.17	1.98	1.24	0.72	0.97
Civilian Labor Force	1.71	1.69	1.18	0.80	0.91
Real Economy (1972 Dollars)					
Potential (Full Employment) Level of Real GNP	3.00	2.93	2.73	2.45	2.24
Gross National Product	2.31	3.57	2.78	2.22	2.42
Industrial Production Index-Total	1.65	4.81	3.16	2.65	3.30
Gross Private Domestic Investment	1.96	4.21	1.48	1.48	2.23
Plant & Equipment Expenditures-Railroads	-1.37	5.20	2.23	1.68	2.92
Plant & Equipment Expenditues-Other Transportation	-3.35	4.20	2.00	1.21	3.43
Real Personal Consumption Expenditures	1.96	3.57	2.82	2.14	2.44
Farm Proprietors Income	0.56	3.38	5.39	5.50	5.75
Energy/Environment					
Imports-Fuels & Lubricants	6.36	3.60	1.25	1.10	1.84
Unit Value Price of U.S. Imports-Fuels	13.91	10.27	9.15	8.31	8.23
Unit Value Price of U.S. Imports-Fuels-Exogenized Value	13.91	10.27	9.15	8.31	8.23
Implicit Price Deflator-Fuels	6.90	6.34	6.67	6.35	6.16
Real Personal Consumption Expenditures-Fuels	2.66	2.81	2.13	1.84	1.83
Wholesale Price Index-Fuels & Lubricants	15.49	10.39	8.56	7.38	7.63
Pollution Abatement Expenditures by U.S. Business	19.80	12.03	8.93	[illegible]	[illegible]
Gross Capital Stock-Pollution Abatement Equipment	9.86	8.38	6.35	[illegible]	[illegible]
Prices					
Implicit Price Deflator-GNP	7.92	7.25	6.02	5.81	5.57
Implicit Price Deflator-Gross Fixed Private Investment	8.02	7.28	6.26	6.86	5.60
Index of Unit Labor Costs-Non Farm Business	7.67	7.21	6.47	6.39	6.18
Consumer Price Index	7.77	7.28	6.24	6.02	5.83
Government					
Federal Government Expenditures	11.15	10.47	9.29	8.83	8.37
State & Local Government Expenditures	11.31	11.28	10.09	9.36	8.90
Government Expenditures as a % of GNP	0.73	-0.25	0.60	0.32	0..43
Foreign Trade/Economic Activity					
Exports of Goods & Services	3.53	5.34	4.02	3.60	4.65
Imports of Goods & Services	2.03	5.11	4.03	3.49	4.50
Industrial Production Index-Canada	5.65	4.90	4.23	4.06	4.24
Industrial Production Index-Japan	5.98	5.92	5.87	5.67	5.60
Industrial Production Index-OECO Countries	3.40	4.23	3.35	3.77	3.96
Composite Price Index-Major U.S. Trading Partners	7.08	7.32	6.71	6.35	6.36
Exchange Rate Index for U.S. Dollars	0.32	-0.53	-0.23	-0.06	0.06
Production of Major Grains Outside the U.S.	2.10	2.09	2.10	2.10	2.10
Financial Markets					
Gross Public Debt Securities	5.01	2.26	0.60	1.27	1.35
Standard & Poors Index of Daily Stock Prices	7.25	5.24	8.81	7.71	6.58
Money Supply-Total	5.54	5.05	6.64	4.83	4.89
Average Yield-New Issues of Corporate Bonds	-2.13	0.22	-1.38	-0.87	-0.08
Average Market Yield-U.S. Govt 20 Year Bonds	-1.13	0.53	-1.61	-0.82	0.18

Table 1-3

National Waterway Study

Data Resources, Inc.
Macro Model of the U.S. Economy

Key Model Forecasts
Growth Rates to 2003

Scenario-BADENERGY2003A

	Compound Annual Percent Change				
	79 to 80	80 to 85	85 to 90	90 to 95	95 to 2003
Demographics and Labor Force					
Total Population, inc. Armed Forces Overseas	0.87	0.96	0.89	0.74	0.68
Population: age 18 to 64	1.48	1.14	0.77	0.54	0.90
Total Employment	1.17	2.04	1.32	0.94	0.95
Civilian Labor Force	1.71	1.75	1.26	0.92	0.98
Real Economy (1972 Dollars)					
Potential (Full Employment) Level of Real GNP	3.00	2.96	2.38	2.59	2.43
Gross National Product	2.31	3.56	2.94	2.59	2.39
Industrial Production Index-Total	1.65	4.73	3.62	3.22	3.41
Gross Private Domestic Investment	1.96	4.29	2.28	1.63	2.13
Plant & Equipment Expenditures-Railroads	-1.37	4.71	2.93	2.20	2.72
Plant & Equipment Expenditures-Other Transportation	-3.36	4.16	3.96	2.08	2.41
Real Personal Consumption Expenditures	1.96	3.60	3.01	2.31	2.54
Farm Proprietors Income	0.56	3.83	4.76	4.54	4.41
Energy/Environment					
Imports-Fuels & Lubricants	6.36	3.32	0.99	1.26	1.16
Unit Value Price of U.S. Imports-Fuels	13.91	11.65	10.60	9.67	9.60
Unit Value Price of U.S. Imports-Fuels-Exogenized Value	13.91	11.65	10.60	9.67	9.60
Implicit Price Deflator-Fuels	6.90	7.13	5.30	5.53	5.32
Real Personal Consumption Expenditures-Fuels	2.66	1.67	2.17	2.24	1.87
Wholesale Price Index-Fuels & Lubricants	15.49	11.60	9.63	8.85	8.50
Pollution Abatement Expenditures by U.S. Business	19.80	11.22	9.89	8.06	7.55
Gross Capital Stock-Pollution Abatement Equipment	9.86	8.21	6.14	4.78	3.63
Prices					
Implicit Price Deflator-GNP	7.92	7.45	6.11	6.84	6.68
Implicit Price Deflator-Gross Fixed Private Investment	8.02	7.48	6.36	6.87	6.56
Index of Unit Labor Costs-Non Farm Business	7.67	7.26	6.25	6.17	6.06
Consumer Price Index	7.77	7.65	6.43	6.20	6.02
Government					
Federal Government Expenditures	11.15	10.36	8.93	8.42	8.07
State & Local Government Expenditures	11.31	11.03	9.63	9.16	8.52
Government Expenditures as a % of GNP	0.73	-0.58	-0.02	0.13	0.14
Foreign Trade/Economic Activity					
Exports of Goods & Services	3.63	6.63	4.60	4.62	4.64
Imports of Goods & Services	2.02	6.11	4.27	4.26	4.42
Industrial Production Index-Canada	6.65	4.82	4.38	4.38	4.31
Industrial Production Index-Japan	6.98	6.61	6.77	6.31	6.65
Industrial Production Index-OECD Countries	3.40	4.12	3.90	3.92	3.97
Composite Price Index-Major U.S. Trading Partners	7.08	7.89	7.29	6.84	6.74
Exchange Rate Index for U.S. Dollars	0.32	-0.54	-0.24	0.01	0.06
Production of Major Grains Outside the U.S.	2.10	2.09	2.10	2.10	2.10
Financial Markets					
Gross Public Debt Securities	6.01	1.98	-0.20	-0.08	0.77
Standard & Poors Index of Daily Stock Prices	7.25	4.69	6.89	7.26	6.13
Money Supply-Total	6.64	6.38	6.03	6.35	4.96
Average Yield-New Issues of Corporate Bonds	-2.14	0.33	-1.87	-0.63	-0.23
Average Market Yeild-U.S. Govt 20 Year Bonds	-1.13	0.70	-1.98	-0.61	-0.03

REPORT OUTLINE

The report is organized as follows: Sections II to XV present the National Waterways Study waterborne demand projections by major commodity groups. Each section contains an industry outlook - summarizes the estimated growth of industry shipments of water-related commodities to the year 2003, a discussion of the waterborne distribution system for the industry as well as potential changes in that system in the future, and the presentation of the waterborne demand projections by segment, traffic type, and physical measure (tons, ton-miles) for each macroeconomic scenario. Section XVI summarizes both the historical total commodity flows by segment on the United States waterway system as well as projected waterborne demands by segment for all commodities through the year 2003. Section XVII presents the conclusions of the study. Appendix A contains a list of National Waterways Study reporting and analysis commodities and waterway segments. Appendix B summarizes the waterborne demand projections by commodity, traffic type, and reporting segment for the alternative macroeconomic scenarios, Larger Government and Bad Energy, to the year 2003.

II - FARM PRODUCTS

INDUSTRY OUTLOOK

Farm products production and export forecasts were generated by an econometric model of the United States agriculture industry which simulates the interactions among production and consumption variables including crop prices, fertilizer prices and application rates, crop yields, livestock prices, domestic grain demand, and foreign grain demand. Important model concepts include acres planted, acres harvested, average yield and total production by eight regions for corn, wheat, soybeans, grain sorghum, barley, oats, and cotton. Corn, wheat, and soybean export forecasts are the key model outputs for this study because over 90% of waterborne farm products tonnage consists of corn, wheat, and soybeans moving to export markets.

(a) Industry Background

The most striking feature of the agriculture industry is the dramatic increase in production and exports of corn, wheat, and soybeans. From 1969 to 1977 production rose from 7,269.9 to 10,223.5 million bushels and exports rose from 1,390.4 to 3,136.9 million bushels. Data for 1978 and 1979 show even stronger growth: in 1979 production totaled 12,173.2 million bushels and exports 4,408.0 million bushels.

Growth in foreign demand for corn, wheat, and soybeans is creating the boom in the agriculture industry. Even though almost two-thirds of production is still consumed domestically, since 1969 export growth has accounted for well over half of the growth in production. From 1969 to 1977 corn exports rose 1,040.5 million bushels (60% of the production increase), wheat exports rose 422.0 million bushels (71% of the production increase), and soybean exports rose 284.0 million bushels (45% of the production increase). During 1978 and 1979 the export share of increased production grew even higher. This trend of an increasing share of new production moving to export markets is important for National Waterways Study because barges carry a large share of grain shipped to export markets, but only a small share of grain shipped to domestic markets.

(b) National and
Regional Forecasts

Table II-1 presents a summary of the baseline agriculture industry forecasts. For all three major grains both production and the percent exported grow. Corn production increases 1.6% per year from 1977 to 1990 and 1.5% per year from 1990 to 2003, with the percent of the crop harvested in the five Corn Belt states rising from 54.0% in 1977 to 63.8% in 2003. From 1977 to 2003 exports grow 2,750 million bushels, accounting for 88.4% of the growth in production, and by 2003, 45.7% of the crop will be exported.

Wheat production rises more slowly, 1.4% per year from 1977 to 1990 and .7% from 1990 to 2003. Production is less concentrated regionally than corn but is becoming increasingly concentrated: the six Plains states that produced 51.2% of the 1977 crop will produce 62.6% in 2003. From 1977 to 2003, export growth will actually exceed producduction growth by 123 million bushels, and by 2003, 63.7% of the crop will be exported.

From 1977 to 1990 soybean production increases the fastest of the three major grains, 2.3% per year, but from 1990 to 2003 the growth rate drops to 1.4% per year. Corn Belt production rises 1.5% per year to 1990 and then declines slightly as that region concentrates on corn production. The Southeast emerges as a major soybean producing area; its growth in production accounts for 37.5% of United States growth and its share of the United States crop rises from 12.5% in 1977 to 22.0% in 2003. During this period total United States soybean production rises 1,077 million bushels while exports increase by 945 million bushels; by 2003 exports aaccount for 54.3% of the crop.

In addition to the baseline TRENDLONG2003A forecasts, agriculture production, consumption, and export forecasts were made for the alternative macroeconomic scenarios BADENERGY and LARGERGOVT. The effects of the alternative scenarios vary from crop to crop. Compared to TRENDLONG2003A, in 2003 LARGERGOVT corn production is 3.3% higher with exports 9.9% higher, wheat production is 1.4% higher with exports 1.4% higher, and soybean production is 1.2% higher and exports 9.5% higher. The BADENERGY forecasts show greater variance from the baseline: in 2003 corn

Table II-1

Agriculture Industry Forecasts - Scenario 3Trendlong2003A
(Million Bushels)

	1977	1980	1985	1990	1995	2000	2003	% Compound Annual Growth 1977 to 1990	1990 to 2003
Corn									
U.S. Production	6,425	6,304	7,458	7,895	8,671	9,084	9,535	1.6	1.5
Corn Belt	3,471	3,809	4,343	4,826	5,323	5,700	6,080	2.6	1.8
Lakes States	1,088	1,029	1,159	1,214	1,473	1,605	1,597	0.8	2.5
Exports	1,604	2,352	2,826	2,599	3,489	4,135	4,354	4.1	3.7
% Exported	25.0	34.6	37.9	34.2	40.2	45.5	45.7	2.4	2.3
Wheat									
U.S. Production	2,036	2,199	2,346	2,439	2,516	2,605	2,683	1.4	0.7
Northern Plains	750	919	1,084	1,200	1,314	1,361	1,193	3.7	1.1
Southern Plains	293	271	290	310	319	303	286	0.4	-0.6
Exports	938	1,302	1,396	1,398	1,405	1,462	1,708	3.1	1.5
% Exported	46.0	59.2	59.5	57.3	55.8	56.1	63.7	1.7	0.8
Soybeans									
U.S. Production	1,762	2,039	2,205	2,269	2,837	2,972	2,839	2.3	1.4
Corn Belt	1,001	1,124	1,174	1,215	1,340	1,290	1,196	1.5	-0.1
Southeast	221	293	353	414	524	605	625	4.5	3.2
Exports	595	833	952	1,075	1,306	1,459	1,540	4.7	2.9
% Exported	33.8	40.9	43.2	45.4	46.0	49.1	54.3	2.3	1.4
Barley									
U.S. Production	424	361	375	333	345	377	387	-1.8	1.2
Grain Sorghum									
U.S. Production	793	829	810	931	922	936	834	1.2	-0.4
Oats									
U.S. Production	751	520	634	629	500	455	443	-1.4	-2.7
Total									
U.S. Production	12,192	12,751	13,829	14,597	15,793	16,421	16,770	1.4	1.1

Corn Belt	Illinois, Indiana, Iowa, Missouri, Ohio
Lakes States	Michigan, Minnesota, Wisconsin
Northern Plains	Kansas, Nebraska, North Dakota, South Dakota
Southern Plains	Oklahoma, Texas
Southeast	Alabama, Delaware, Florida, Georgia, Kentucky, Maryland North Carolina, Tennessee, Virginia, South Carolina

production is 3.8% lower with exports 4.0% higher, wheat production is 5.9% higher with exports 13.9% lower, and soybean production is 21.7% lower with exports 21.9% lower. Decreases in domestic consumption and stock adjustments allow exports to rise while production falls.

(c) Key Industry Developments

Cultivating additional cropland causes some of the increases in production but most results from increased yields. Corn acreage harvested rises from 70.9 million in 1977 to 77.7 million in 2003, wheat acreage from 66.5 to 72.2 million, and soybean acreage from 57.6 to 77.9 million. Meanwhile the average corn yield rises from 91 to 121 bushels per acre, the wheat yield from 31 to 42 bushels per acre, and the soybean yield from 31 to 38 bushels per acre. The projected 32.8 million acre increase in corn, wheat, and soybean harvests will come from increased utilization of marginal and set-aside lands, from land diverted from other crops, and from increased double-cropping. Increased yields are expected to come mainly from improved varieties and increased fertilization, including wider use of micronutrients.

The agriculture industry model estimates that new hybrids and improvements in farming techniques will continue to increase yields and that the average climate in major grain-producing regions will not change for the worse. The estimate that average yields will increase is based on substantial improvements in yields over the past decade, particularly for corn and soybeans, but it carries risks. Unexpectedly poor weather can dramatically reduce yields, and if expected progress in developing higher-yield varieties fails to materialize, less grain will be produced.

DISTRIBUTION SYSTEM

Trucks, railroads, and barges all play major roles in grain transportation. Trucks provide mainly short-haul carriage, most often serving local domestic markets and carrying grain to barge and unit train terminals. Railroads have yielded most short-haul traffic to trucks and concentrate on serving export markets and more distant domestic markets like the Southeast chicken-feed market. Barges

serve mainly export markets, with over 90% of all barge grain shipments sent to exporting regions.

(a) Role of Water Transportation

Barge grain traffic is highly concentrated. Six rivers - the Illinois, Upper Mississippi, Lower Upper Mississippi, Lower Mississippi, Ohio, and Columbia/Snake - loaded 84% of total barge grain tonnage in 1977. Almost all Columbia/ Snake wheat is shipped to the Portland area and 88% of all corn, wheat, and soybeans loaded on the Mississippi River system in 1977 was bound for the New Orleans area. While barge shipments to export markets have grown rapidly, barge shipments to domestic markets have been stable or declining. Corn shipments from the Illinois to Tennessee River appear to have stabilized after dropping sharply during the early 1970s as a result of increased rail competition. Barge corn shipments to other major domestic markets have shown relatively little change, fluctuating between 530,000 and 810,000 tons from 1972 through 1977. Barge wheat shipments to domestic markets averaged 1.3 million tons from 1969 to 1977 showing no growth, and barge soybean shipments to domestic markets declined from 710,000 tons to 520,000 tons between 1972 and 1977.

(b) Factors Affecting Modal Choice

If barge grain origin-destination patterns are relatively straightforward, modal competition patterns are complex. For example, elevators in Central Illinois commonly ship their corn and soybeans by truck to barge terminals on the Illinois River by truck to local processors, by truck to unit train terminals that ship to Gulf or Atlantic ports, by rail to the Southeast feed market, and by truck to Chicago export terminals. Competition is not limited to mode choice within corridors; barges compete not only with railroads serving Gulf ports but also with railroads and trucks serving other export regions and domestic markets. The market share captured by any combination of mode and destination is determined by the relative rates for barge, rail, and truck transportation and by the strengths of the alternative markets as reflected in their bids.

The combination of bids at alternative markets and relative transportation costs generally determine modal choice. (Railcar availability is another frequently mentioned issue, but since shippers can lease or purchase railcars this issue falls in the transportation cost category.) Bids vary as the demand for grains in various markets rises and falls, but in general, export elevators set prices and inland terminal elevators respond with bids reflecting export elevator bids, the cost of shipping to the export elevator, handling costs, and profits. Domestic feedlots and processors have relatively inelastic demand for grain and offer bids high enough to draw the desired quantities.

Barge rates, because they are unregulated, can respond quickly to changes in demand. This enables barge operators to charge premium rates during peak demand periods and to maintain high levels of utilization during low demand periods. Rail rates are regulated and cannot respond to demand fluctuations. As a consequence, railroads cannot meet the shipper demand for cars during peak periods and suffer substantial traffic losses when demand falls. Intra-state truck grain rates are regulated in 21 states but enforcement of regulation is often neglected.

A hypothetical example can best illustrate the interactions among elevator bids, transportation costs, and mode choice. Consider an area 100 miles wide stretching from a waterway barge terminal to an inland rail terminal. Both terminals ship to Gulf ports where the export price for corn is $3.00/bushel. The barge rate to the Gulf is $.30/bushel and the rail rate $.33/bushel, so the barge terminal can offer a bid $.03 higher than the rail terminal and maintain an equal margin for handling and profit. If the local truck rate is $.05/bushel for the first ten mile block and $.01 for every additional block, the $.03 premium will cover the cost of trucking grain an additional 30 miles. Country elevators up to 65 miles away from the river will find it more profitable to sell to the barge terminal, while elevators further from the river will ship to the rail terminal. If increased demand causes the Gulf bid to rise $.03/bushel and a resulting increase in demand for grain transportation causes the barge rate to rise $.03/bushel, the rail elevator will be able to offer a bid equal to the barge terminal bid because regulations keep rail rates from rising. The barge terminal drawing area then shrinks from 65 to 50 miles and the rail drawing area increases correspondingly.

(c) Distribution System Developments

The grain distribution system has undergone several major developments during the past decade. Most striking is the growth of unit train service, accompanied by investment in unit train loading equipment at many terminals and the replacement of most grain-hauling boxcars with 100-ton covered hoppers. A second development is the increased use of floating grain loaders which transfer grain directly from barges to ocean-going vessels. These floating loaders have reduced the pressure to construct additional export elevator capacity, an investment which many firms have been reluctant to make because export elevators traditionally operate on a very small margin.

Rising fuel prices also affect grain transportation. Rising truck costs generally favor rail over barge because rail terminals are more dispersed geographically, making the truck haul to rail terminals shorter on average than the truck haul to barge terminals. Barge costs are influenced more strongly by fuel price increases than rail costs because fuel costs are a larger percentage of total barge costs. Rising bunker fuel prices have also increased the pressure to reduce ocean shipping distances; this is most evident in the increasing share of shipments to the Far East being loaded at Pacific ports.

These factors indicate that rising fuel costs tend to improve the competitive position of rail against barge, but rising labor and capital costs offset the rail fuel cost advantage. Railroads, with their low return on investment and need for additional capital, are likely to raise their rates rather than attempting to gain market share by keeping rates low. Unit train service will continue to grow, but at roughly the same rate as export growth. As a consequence, rail and barge market shares will remain ralatively constant.

The risk that the grain distribution system will undergo major change appears slight. Under deregulation railroads will have increased rate-making freedom and they may decide that pricing to decrease their market share will maximize profits. Continued federal intervention in international grain marketing may also alter grain flows. However,

the grain distribution system is shaped by strong and relatively stable economic forces, and changes in the system over the next 25 years are likely to be small.

WATERBORNE DEMAND PROJECTIONS

The model which produces waterborne demand projections for corn, wheat, and soybeans takes the export forecasts generated by the agriculture industry model, determines the waterborne share, and allocated shares of total waterborne exports to the Gulf, Atlantic, Great Lakes, and Pacific Coasts on the basis of past trends and projected changes in the grain industry. Export shipments from each coastal region are shared among the analysis segments within each region primarily on the basis of historical shares, although these shares are modified in several instances because of specific industry information. Shipments from river segments to exporting regions grow in proportion to exports; shipments to domestic markets are held constant at 1977 levels after study of trends and market forces.

A separate procedure was used to generate projections for farm products other than corn, wheat, and soybeans. Exports of sorghum, oats, rice, flaxseed, cotton, and leaf tobacco were generated by the agriculture industry model while exports of the "all other" category were forecast using the relationship between "all other" and the constant dollar food, feed, and average export forecasts generated by the macroeconomic model. Imports of bananas, fresh fruits, and tree nuts follow United States population trends because per capital consumption appears stable, and coffee imports are projected to remain relatively stable. Domestic traffic for farm products other than corn, wheat, and soybeans is determined by the past relationship between domestic and foreign traffic or held constant.

(a) Summary

Barge shipments of farm products are concentrated on six rivers: the Upper Mississippi, Lower Upper Mississippi, Lower Mississippi, Illinois, Ohio, and Columbia/Snake. Between 1977 and 1990, average yearly growth on these rivers ranges from 4.3% on the Upper Mississippi to 2.0% on the Illinois; between 1990 and 2003, growth ranges from 3.3% on

the Illinois to 1.6% on the Columbia/Snake. Corn, wheat, and soybean shipments account for almost all growth. Although "other farm products" shipments grow from 2.2% to 3.6% per year, tonnage of these products remains relatively small. "Other farm products" shipments on the Lower Mississippi, the major inland shipper of these products, constitute only 5.9% of that segment's total farm products shipments in 2003.

Major growth in receipts is limited to three segments: Baton Rouge to Gulf, the Warrior System, and the Columbia/Snake. Almost all receipts at Baton Rouge to Gulf are corn, wheat, and soybeans and grow steadily at 3.2% per year. Warrior System receipts are mainly soybean receipts at Mobile; total receipts grow 6.1% per year from 1977 to 1990 and 2.8% per year from 1990 to 2003. Columbia/Snake receipts are almost entirely wheat receipts in the Portland-Longview regions; total receipts grow 4.2% per year from 1977 to 1990 and 1.6% from 1990 to 2003.

(b) Major Market Shifts

The farm products demand projections reflect two major market shifts. First, the developpment of unit train service from Nebraska and western Iowa to Washington and California export regions has caused dramatic growth in corn exports from the Pacific Coast. This, in turn, has caused changes in Pacific Coast wheat exporting patterns. Tacoma has emerged as a major corn-exporting region and wheat that used to flow through Tacoma is being diverted to other Pacific Coast ports. Second, the Southeast is expected to become a major soybean producing region as the Corn Belt concentrates increasingly on producing corn. As a result, shipments on the Warrior River System are projected to grow 7.5% per year from 1977 to 1990 as Mobile develops into a major soybean exporting center, and growth on the Warrior from 1990 to 2003 will be exceeded or matched by only two rivers, the Illinois and the Ohio.

These two shifts are expected to have relatively small modal impacts. Whether moving to the Pacific or the Gulf Coast, corn from Nebraska and western Iowa is shipped predominantly by rail because of high barge costs on the Missouri. The modal impact of increased soybean production and exports in the Southeast is less straightforward because

historical trends are not good indicators of the impacts of a major production shift, but industry interviews suggest that barge and rail will share equally in traffic growth in this region.

(c) Waterborne Flow Changes

Virtually all the growth in domestic farm products traffic is a result of growth in the export market for corn, wheat, and soybeans. Shipments of corn, wheat, and soybeans to domestic markets are projected to remain constant, and shipments of "other farm products" account for relatively little tonnage. Table II-2 presents domestic shipments and receipts for all reporting segments, and Table II-3 presents the segment loadings for the Mississippi River System and Great Lakes. The largest growth in domestic shipments occurs on the Upper Mississippi which ships an additional 18.2 million tons of farm products in 2003, followed by the Illinois which ships an additional 14.3 million tons. Since most river shipments are bound for the Baton Rouge to Gulf region, the segment loadings increase more as you move downstream. Projected ton-miles, shown in Table II-4, also reflect this shipment pattern. Growth is greatest on the Lower Mississippi, where ton-miles of farm products increase from 25.6 billion in 1977 to 57.5 billion in 2003, because most shipment from upstream segments pass through the Lower Mississippi on their way to the Baton Rouge to Gulf area. Domestic coastwise and lakewise traffic and domestic ton-miles on the Great Lakes show little growth because most activity on the coasts and lakes is in foreign trade.

Table II-5 presents the foreign trade projections; all major growth is in exports. Shipments from the Baton Rouge-Gulf region increase by 53.1 million tons, and that region continues to handle the largest share of exports. The Washington/Oregon Coast, California Coast, and Warrior System show exceptionally strong growth from 1977 to 1990 as a result of the markets shifts mentioned previously. The Illinois River (Chicago region) and other Great Lakes also show strong growth but much of this growth occurs between 1977 and 1980 and reflects an unusually poor base year. Middle Atlantic Coast exports grow fairly steadily from 3.1% to 3.4% per year; but after strong growth from 1977 to 1980, exports from the Gulf Coast West and Columbia/Snake grow slowly as a result of slow growth in the world wheat market.

Table II-2

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY: Farm Products
ALTERNATIVE: TrendLong2003A

SEGMENT	IN/OUT	1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
Upper Mississippi	Shipped	11,547	17,334	20,075	19,912	24,441	28,051	29,726	4.1	3.1
	Received	43	44	44	45	45	46	46	0.3	0.1
Lower Upper Mississippi	Shipped	3,046	3,334	4,233	4,382	5,154	5,773	6,201	2.8	2.7
	Received	279	292	301	313	319	334	343	0.9	0.7
Lower Mississippi	Shipped	4,370	5,526	6,293	7,068	8,423	9,515	10,183	3.8	2.8
	Received	694	698	738	706	708	[illegible]	[illegible]	[illegible]	0.1
Baton Rouge to Gulf	Shipped	837	841	814	851	856	865	870	0.1	0.2
	Received	37,781	48,664	56,621	57,197	70,431	80,833	85,457	3.2	3.2
Illinois River	Shipped	14,941	16,800	19,629	17,249	24,014	27,738	29,217	2.0	3.3
	Received	154	155	155	155	155	156	156	0.0	0.0
Missouri River	Shipped	1,223	1,609	1,774	1,757	1,887	2,02[illegible]	2,20[illegible]	2.8	1.8
	Received	6	6	6	6	6	6	6	0.0	0.0
Ohio River	Shipped	4,292	5,233	6,091	6,163	7,606	8,726	9,251	2.8	3.2
	Received	197	202	201	208	211	216	218	0.4	0.4
Tennessee River	Shipped	218	157	173	181	210	232	242	1.4	2.3
	Received	1,462	1,474	1,474	1,494	1,500	1,514	1,522	0.2	0.1
Arkansas River	Shipped	1,034	1,188	1,314	1,448	1,670	1,835	1,959	2.6	2.4
	Received	7	7	7	7	7	7	7	0.0	0.0
Gulf Coast West	Shipped	552	604	613	701	740	815	860	1.9	1.6
	Received	271	314	313	385	406	458	487	2.7	1.8
Gulf Coast East	Shipped	208	219	223	242	253	272	283	1.2	1.2
	Received	740	714	749	756	765	775	783	0.2	0.3
Warrior River System	Shipped	730	1,400	1,645	1,861	2,320	2,651	2,[illegible]	7.5	3.2
	Received	975	1,613	1,885	2,097	2,5[illegible]	2,8[illegible]	3,[illegible]	6.1	2.8
South Atlantic Coast	Shipped	107	111	116	122	[illegible]	140	14[illegible]	[illegible]	1.4
	Received	9	11	12	11	[illegible]	[illegible]	22	1.3	3.6
Middle Atlantic Coast	Shipped	574	6[illegible]	652	[illegible]	[illegible]	[illegible]	[illegible]	1.6	2.2
	Received	4[illegible]	512	[illegible]	599	[illegible]	[illegible]	[illegible]	1.7	2.2

Table 11-2 (continued)

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Shipped	6	7	8	9	11	13	15	3.3	1.6
	Received	2	2	3	3	4	5	5	3.3	3.6
Great Lakes and Seaway	Shipped	1,475	1,530	1,530	1,530	1,530	1,530	1,530	0.3	0.0
	Received	1,475	1,530	1,530	1,530	1,530	1,530	1,530	0.3	0.0
Washington/Oregon Coast	Shipped	65	72	81	92	107	125	139	2.8	3.2
	Received	2	3	3	4	4	5	6	3.3	3.3
Columbia Snake Willamette River	Shipped	3,460	5,437	5,849	5,885	5,922	6,193	7,275	4.2	1.6
	Received	3,425	5,401	5,812	5,846	5,880	6,147	7,227	4.2	1.6
California Coast	Shipped	264	295	339	393	461	547	610	3.1	3.4
	Received	73	80	89	100	114	131	144	2.4	2.9
Alaska	Shipped	a	a	a	a	a	a	a	3.3	3.6
	Received	40	45	52	60	71	85	95	3.2	3.5
Hawaii and Pacific Territories	Shipped	389	438	506	591	698	813	931	3.3	3.6
	Received	520	582	667	774	908	1,078	1,201	3.1	3.4
Domestic Caribbean	Shipped	77	79	83	88	93	101	106	1.0	1.5
	Received	776	814	868	935	1,019	1,126	1,203	1.4	2.0
Total	Shipped	49,416	63,222	72,028	73,232	87,311	98,858	105,477	3.1	2.8
	Received	49,416	63,222	72,028	73,232	87,311	98,858	105,477	3.1	2.8

a = less than 500 tons

Table II-3

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC: INBOUND, OUTBOUND, LOCAL, AND THROUGH

COMMODITY: [illegible]
ALTERNATIVE: [illegible]

[illegible]	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	[illegible]
Upper Mississippi	13,558	17,345	20,086	19,923	24,452	28,062	29,[illegible]	4.1	3.1
Lower Upper Mississippi	30,632	39,351	45,542	45,171	55,369	63,453	67,213	[illegible]	3.1
Lower Mississippi	38,711	49,590	57,550	58,118	71,352	81,811	86,873	3.2	3.1
Baton Rouge to Gulf	33,145	50,048	58,009	58,617	71,866	82,356	87,438	[illegible]	3.1
Illinois River	14,982	16,841	19,670	19,289	24,055	27,779	29,258	2.0	3.3
Missouri River	1,229	1,615	1,740	1,763	1,894	2,027	2,211	2.8	1.8
Ohio River	5,965	6,860	7,733	7,839	9,319	10,490	11,024	2.1	2.7
Tennessee River	1,663	1,614	1,629	1,656	1,691	1,727	1,745	0.0	0.4
Arkansas River	1,040	1,195	1,321	1,454	1,677	1,842	1,966	2.6	2.3
Gulf Coast West	697	767	775	892	939	1,035	1,092	[illegible]	1.6
Gulf Coast East	1,285	1,303	1,312	1,341	1,361	1,392	1,413	0.3	0.4
Warrior River System	1,162	1,833	2,079	2,297	2,757	3,089	3,230	5.4	2.7
Great Lakes	1,475	1,530	1,530	1,530	1,530	1,530	1,530	0.3	0.0

* = less than 500 tons

Table II-4

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY: Farm Products
ALTERNATIVE: [illegible]

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	4,569	6,860	7,946	7,881	9,674	[illegible]	11,766	4.3	3.1
Lower Upper Mississippi	6,456	8,311	9,616	9,544	[illegible]	13,452	14,247	3.?	3.1
Lower Mississippi	25,576	32,840	38,179	38,341	47,185	54,181	57,541	3.2	3.2
Baton Rouge to Gulf	4,993	6,359	7,359	7,421	[illegible]	10,393	11,037	[illegible]	3.1
Illinois River	2,601	2,925	3,411	3,352	4,194	4,834	5,091	2.0	3.3
Missouri River	500	775	835	846	[illegible]	972	1,061	2.8	1.8
Ohio River	1,422	1,690	1,955	1,970	2,415	2,767	2,924	2.5	3.1
Tennessee River	596	597	598	602	612	620	624	0.1	0.2
Arkansas River	237	272	301	311	392	419	447	2.6	2.3
Gulf Coast West	115	125	125	141	146	159	165	1.6	1.2
Gulf Coast East	96	98	98	102	103	106	108	0.5	0.5
Warrior River System	84	165	194	220	275	315	331	7.7	3.2
Great Lakes	1,217	1,255	1,255	1,255	1,255	1,255	1,255	0.2	0.0
Total.	48,551	62,271	71,900	72,015	87,945	100,578	106,600	3.1	3.1

a = less than 500,000 ton miles

Table II-5

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY: Farm Products
ALTERNATIVE: Trendlong2003A

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	43,064	53,500	62,675	67,341	78,585	90,557	96,191	3.0	3.3
	Imports	236	246	250	255	260	264	267	0.6	0.4
Illinois River	Exports	1,353	3,133	3,730	3,692	4,698	5,492	5,793	8.0	3.5
	Imports	3	3	3	3	3	3	3	0.6	0.4
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	20,738	29,153	33,101	35,821	39,879	44,615	49,952	4.3	2.6
	Imports	313	327	332	339	345	351	355	0.6	0.4
Gulf Coast East	Exports	2,751	2,618	3,126	3,383	4,148	4,860	5,223	1.6	3.4
	Imports	709	739	751	766	782	795	803	0.6	0.4
Warrior River System	Exports	1,317	2,825	3,369	3,880	4,861	5,650	5,999	8.7	3.4
	Imports	67	70	71	72	74	75	76	0.6	0.4
South Atlantic Coast	Exports	691	986	1,174	1,327	1,614	1,879	2,022	5.1	3.3
	Imports	441	460	467	477	486	494	499	0.6	0.4
Middle Atlantic Coast	Exports	13,055	16,550	19,585	19,445	24,409	28,449	30,199	3.1	3.4
	Imports	1,944	2,027	2,058	2,102	2,141	2,179	2,202	0.6	0.4

Table 11-5 (continued)

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Exports	76	86	104	129	152	178	195	4.1	3.2
	Imports	22	23	23	23	24	24	25	0.6	0.4
Great Lakes and Seaway	Exports	9,610	13,844	15,957	16,577	19,459	22,104	24,115	4.3	2.9
	Imports	135	139	141	143	145	147	149	0.4	0.3
Washington Oregon Coast	Exports	1,626	5,639	6,694	6,519	8,[illegible]	9,591	10,207	11.[illegible]	[illegible]
	Imports	16	16	17	17	17	18	18	0.6	0.4
Columbia Snake Willamette River	Exports	6,521	10,099	10,950	11,139	11,343	11,965	13,991	4.2	1.8
	Imports	5	5	6	6	6	6	6	0.6	0.4
California Coast	Exports	3,236	5,902	6,974	7,646	9,108	10,594	11,526	6.8	3.2
	Imports	575	600	609	622	634	645	651	0.6	0.4
Alaska	Exports	a	a	a	a	a	a	a	4.1	3.2
	Imports	6	6	6	6	6	6	6	0.1	0.1
Hawaii and Pacific Territories	Exports	3	3	4	4	5	6	7	4.1	3.2
	Imports	2	2	2	2	3	3	3	0.6	0.4
Domestic Caribbean	Exports	17	19	23	29	34	39	43	4.0	3.2
	Imports	129	132	133	134	135	136	[illegible]	0.1	0.2
Total	Exports	104,059	144,[illegible]	167,466	172,933	206,468	235,960	[illegible]	4.0	3.0
	Imports	4,603	4,796	4,867	4,968	5,064	5,146	5,199	0.6	0.4

a = less than 500 tons

III - METALLIC ORES

INDUSTRY OUTLOOK

United States metallic ore requirements and supplies are forecast in their major component parts for the National Waterway Study. Iron ore demand - by far the largest component - is related to blast furnace and steel furnace production. Raw steel production is, in turn, related to the finishing and shipment of mill products, which are based on activity measures for 21 specific end-markets as well as relative domestic and foreign prices. Relative production costs determine steel furnace mix, and the level of production and technology mix in each region determine that region's iron ore requirements. Iron ore receipts by source are related to the costs of domestic versus foreign ore as well as the location of the receiving facility.

The demand for aluminum ores and concentrates is related to aluminum production in the United States, taking into account such factors as secondary recovery of aluminum from scrap and the increasing share of alumina versus bauxite in the large imported volume - a trend which reduces the transportation demand associated with any given level of metallic content.

The demand for the relatively minor other ores (manganese, chromium, etc.), which are nearly entirely import-oriented, is related to production activity in the metals industry.

(a) Industry Background

1. Iron Ore. Iron ore enters the steel production process as an input to the blast furnace for the production of pig iron - an intermediate step on the way to raw steel - and, to a lesser extent, as a direct input to the steel furnace. In 1977, 119.4 million short tons of iron ore and agglomerates were consumed at United States iron and steel plants in the production of 81.3 million short tons of pig iron and 125.3 million short tons of raw steel. Iron ore consumption is obviously closely related to the strength of domestic steel production, but the iron ore input per ton of raw steel produced has fallen from about

1.05 short tons in the mid-1960s to .96 in 1977 (and .94 in 1978). This decline is due to two key factors; a shift away from ore-intensive technologies and toward scrap-intensive electric furnaces, and a trend toward shipment of more concentrated ore from mines. Thus, scrap-based electric furnaces accounted for 22% of United States raw steel production in 1977 (25% in 1979) up from 10% in 1965.

Another recent development which has major implications for the future of the iron ore industry is the direct reduction of iron ore for use in electric furnaces as a replacement for scarce and expensive iron and steel scrap. Although this technology is currently operational at only a few facilities, it is being studied and tested by nearly all major producers and is likely to provide the basis for steel expansion for the remainder of the century.

The regional distribution of raw steel production has been changing over the last decade, with older producing areas such as Buffalo (down from 4.3% of United States production in 1970 to 2.88% in 1979) and the Northeast Coast (down from 13.7% to 10.8%) losing market share, and others such as Chicago (up from 21.7% to 25.5%) and Detroit (up from 7.3% to 8.3%) showing gains. This migration is also reflected in the distribution of regional iron ore consumption. Thus, while Illinois and Indiana accounted for 21.8% of ore consumption in 1967, steel production in those states used 27.1% of United States ore consumption in 1979. The Mideast - consisting of New York, Pennsylvania, and Ohio - on the other hand, accounted for only 39.6% of total ore consumption in 1979, down from 46.2% in 1967. Iron ore sources have also been changing over time. The import share slipped from 35.8% in 1971 to 29.7% in 1979, with most of the decline representing overseas, as opposed to Canadian ore. While Canadian Great Lakes sources also lost market share in the United States, the share of Eastern Canadian ore increased from 13%-14% in the early 1970s to 16%-17% at the end of the decade. Ore from the United States Northeast and South has declined from 6% of United States consumption in 1971 to 1% in 1979, while the United States Lake Superior region has increased its market share from 55% to 62% over the same period.

2. Non-Ferrous Ores. Aluminum ores and concentrates consist primarily of bauxite (crude aluminum ore) and alumina (concentrated from bauxite). The chief use of bauxite in the United States is in the production of alumina for input into the production of aluminum metal. Less than 10%

of bauxite goes into other industries particularly abrasives, chemicals, and refractories. In 1977, 14.3 million long tons of bauxite were consumed in the United States, with imports supplying 89.5% or 12.8 million long tons. Thirteen and one-third million long tons of bauxite (93% of total consumption) were required in 1977 to produce 8.7 million short tons of alumina, which was supplemented by an additional 4.1 million tons of imported alumina.

In recent years, domestic production and imports of bauxite have been steady, with increases in demand satisfied by growing alumina imports. Thus, while bauxite production and imports amounted to 1.98 and 12.8 million long tons respectively in 1977, compared to 1.99 and 12.3 million tons in 1971, alumina imports increased from 2.4 million short tons to 4.1 million short tons between 1971 and 1977.

Other ores are subject to similar phenomena, with a trend toward more concentrated commodities such as ferromanganese and other ferroalloys substituting for crude ores in the import and transportation base. In contrast to the case of aluminum ores, for which the concentrated form of the material is in the same commodity grouping as the crude form, ferroalloys are classified as primary metals as opposed to metallic ores and, therefore, are treated elsewhere in this report.

(b) National and Regional Forecasts

1. Iron Ore. Raw steel production is projected to grow from 136.7 million net tons in 1978 to 206.4 million tons in 2003. This is an increase of 69.7 million tons, or 51%. The implied average annual growth rate over the 25 year period is 1.7%. Growth is less if measured from the previous 1973 peak of 150.4 million tons. From that peak, the increment to 2003 is 56 million tons or 37%.

Raw steel capacity is projected to expand from 173 million tons in 1978 to 225 million tons in 2003, to support the growth in production. This is an increase of 52 million tons, or 30%. This rise in capacity is assumed to come from round-out rather than greenfield expansion, and is expected to include more continuous casting, new vessels at basic oxygen furnace shops, use of direct reduced iron as a supplemental blast furnace feed, and other measures designed to increase productivity.

Basic oxygen furnace output is projected to increase from 83.5 million tons in 1978 to 112.9 million tons in 2003. This is an increase of 29.4 million tons, or 35%. As a result, the basic oxygen furnace share in total steel output drops from 61% in 1978 to 54.7% in 2003. The share is temporarily higher, at 66% in 1980-1982 period, due to low total steel production and a disproportionate drop in open hearth output. The major factor in the longer-term slowdown of basic oxygen furnace capacity expansion and its declining share of total steel production is its high capital cost relative to that of electric furnaces. Electric furnace output is projected to increase from nearly 32 million tons in 1978 to 87.3 million tons in 2003. This is an increase of 55.3 million tons, or 174%. As a result, the electric furnace share of total rises from 23.4% in 1978 to 42.3% in 2003. Finally, open hearth furnace output is projected to decrease from 21.3 million tons in 1978 to the 10.5-13.6 million ton range in the sluggish environment of 1980-1982, then to increase to nearly 15 million tons in the strong growth period through 1986. Thereafter, these more costly furnaces are gradually replaced by electric furnaces. Open hearth output is projected to drop steadily to 6.2 million tons by 2003. As a result, the open hearth share of total drops from 15.6% in 1978 to 3.0% in 2003.

Although raw steel production is projected to grow in all producing areas over the forecast period, rates of growth will vary among regions (Table III-1). Changing furnace mix by region and installation of direct-reduction facilities introduce another variant in growth rates for regional iron ore consumption. While steel production in the South grows at a compound rate of 2.2% per year between 1977 and 2003, at the other extreme, iron ore requirements grow at 4.1% per year.

Changing regional demands also lead to a slow shift in iron ore sources over the forecast period, with the import share rising from 29.7% in 1979 (34.4% in 1977) to 32.4% in 2003. This increase reflects the rapid growth of ore requirements in the South over the forecast period, coupled with the flatness of that region's iron ore production. The market share of the United States Lake Superior region declines from 62% to 59% by the end of the forecast period, primarily due to slower growth of demand in regions consuming that ore.

Ore consumption is lower under both macroeconomic alternatives than under the TRENDLONG alternative described above. Under the LARGERGOVT case, iron ore consumption in 2003 is 184.8 million gross tons - compared to 199.0 million under TRENDLONG2003 - while 190.7 million gross tons are required in that year under the BADENERGY alternative. Imports, on the other hand, are 65.6, 60.2, and 63.0 million tons in 2003 under TRENDLONG, LARGERGOVT, and BADENERGY, respectively.

2. Non-Ferrous Ores. Imports of bauxite and alumina are projected to grow from 16.5 million short tons in 1977 to 28.9 million tons in 2003, as domestic bauxite mining remains flat and the fraction of metal derived from scrap stabilizes. This increase is somewhat slower than the increase in demand for imported metallic content because it is estimated that the share of requirements imported as alumina, as opposed to less concentrated bauxite, will increase from 36.2% in 1977 to 45% by 2003.

(c) Key Industry Developments

A key assumption behind National Waterway Study steel industry projections is that domestic steel procedures will be able to retain historic market shares of United States steel mill product consumption (85%), up from the depressed levels of 1978 (82%). While the domestic market share increased to 84.5% in 1979, the real test will come when demand heats up later in the 1980s. As increased import share would mean less United States raw steel production and lower iron ore consumption. This assumption is based on the expectation that excess capacity of foreign producers will be reduced by growth in demand overseas and that funds for United States capacity expansion will be available from sources other than increased product prices, which would encourage imports. Changes in tax laws governing depreciation are one important possibility. Alternative steel industry projections for cases in which import market shares are not restrained by these factors have also been developed for inclusion in alternative National Waterway Study scenarios.

A second key factor in the steel industry projections relates to an estimate that direct reduced (DR) iron will fill the gap between scrap supply and demand at a price of

Table III-1

IRON ORE FORECASTS
Scenario Trendlong2003A

	1977	1980	1985	1990	1995	2000	2003	% GROWTH 77 TO [illegible]	% GROWTH 90 TO 2003
RAW STEEL PRODUCTION (1000'S OF Short Tons)									
UNITED STATES	124,732	130,434	149,766	165,858	180,357	196,148	206,428	2.2	1.7
Buffalo	4,145	3,888	4,261	4,688	5,089	5,585	5,933	1.[illegible]	1.8
Chicago	30,045	34,140	38,593	42,488	46,144	50,483	53,615	2.[illegible]	1.8
Cincinnati	5,705	5,636	6,607	7,387	8,006	8,720	9,260	2.[illegible]	1.8
Detroit	9,947	11,322	12,417	13,719	14,888	16,323	17,337	2.5	1.8
Northeast	13,379	12,943	16,600	17,525	19,142	20,465	20,140	2.[illegible]	1.1
Pittsburgh	22,157	23,062	26,615	29,200	31,927	34,798	36,951	2.1	1.8
South	10,358	11,037	12,375	14,604	15,793	17,025	18,070	2.7	1.7
St. Louis	3,898	4,341	4,793	5,511	5,989	6,492	6,893	2.2	1.7
West	7,854	8,048	9,640	10,492	11,517	12,446	12,919	2.3	1.6
Youngstown	8,536	7,015	7,848	9,164	9,916	10,718	11,377	0.5	1.7
IRON ORE (1000'S Gross Tons)									
UNITED STATES									
Consumption	108,462	113,885	127,021	143,164	162,148	183,957	199,046	2.2	2.6
Imports	37,906	33,810	39,189	45,219	52,151	60,137	65,573	1.4	2.9
Exports	1,965	2,996	2,996	2,996	2,996	2,996	2,996	3.3	0.0
Domestic Shipments	91,147	93,491	108,667	122,108	135,138	150,548	160,854	2.3	2.1
REGIONAL CONSUMPTION									
Buffalo	4,715	3,928	4,234	4,688	5,143	5,709	6,132	0.0	2.1
Chicago	29,044	33,477	36,599	39,608	44,100	49,528	53,624	2.4	2.4
Cincinnati	5,389	5,393	5,555	6,122	7,069	8,078	8,850	1.0	2.9
Detroit	9,083	11,088	11,969	13,372	14,768	16,456	17,721	3.0	2.2
Northeast	10,497	9,945	13,126	14,562	16,980	19,008	19,176	2.5	2.1
Pittsburgh	19,810	20,689	23,657	25,828	28,500	32,490	35,534	2.1	2.5
South	5,427	5,642	6,033	8,722	11,206	13,517	15,325	3.[illegible]	4.4
St. Louis	2,526	2,836	3,131	3,999	4,814	5,624	6,251	3.6	3.5
West	6,326	6,300	7,627	8,726	9,753	11,181	12,027	2.5	2.5
Youngstown	5,823	4,167	4,440	6,011	7,473	8,872	9,962	0.2	4.0

$110 per ton, the current estimated cost of direct reduced iron. An alternate case in which the cost of direct reduced iron turns out to $130 per ton has also been developed for inclusion in alternate National Waterway Study scenarios. In this case, scrap inputs to the United States steel industry are higher than described above, and iron ore demand correspondingly lower.

DISTRIBUTION SYSTEMS

(a) Role of Water Transportation

1. Iron Ore. Iron ore is the most heavily water-oriented of all the steel industry raw materials and products, although only a small fraction of this commodity moves on the inland waterways. Ores from the United States and Canadian Great Lakes ore-producing regions more predominately by Lakes bulker from the mining region to lower Lakes ports where they are consumed at lakefront plants or transhipped by rail or truck to steel plants in the interior. Great Lakes ore provides the overwhelming share of ore consumed in the Great Lakes and Ohio River Valley steel regions, but seldom moves south of the Ohio River or west of the Mississippi River. Ore from the other domestic mining districts moves by rail and is not realistically water-competitive.

About two-thirds of Eastern Canadian iron ore enters the Great Lakes via the Saint Lawrence Seaway and serves the same consuming area as the Lake Superior ore. The remainder of the Eastern Canadian ore as well as nearly all of the overseas foreign ores enter the United States at coastal ports. Ore imported at coastal ports is generally consumed within the port area, either at waterfront facilities or after a short rail movement inland (e.g., 50 miles from Philadelphia to Bethlehem, Pennsylvania). There are several exceptions to the pattern, however. First, 4-5 million tons of ore per year move from Eastern Pennsylvania and Maryland to the Western Pennsylvania and Ohio River Valley, with very small amounts occasionally going as far as Chicago. As much as half of this may historically have been from the now defunct iron ore mines in Eastern Pennsylvania. The remainder is import ore. Secondly, the ore imported at Wilmington, North Carolina moves down the Atlantic Intracoastal Waterway to Georgetown, South Carolina for the steel

facilities there. Third, Alabama iron and steel production takes place in the Birmingham-Gasden belt, near metallurgical coal sources, and thus import ore requires transportation 300-400 miles beyond the Mobile port area. The inland movement is by barge or rail depending on the receiving plant. Finally, less than 1 million tons of specialty ore is imported at Baton Rouge for movement by barge to inland plants - particularly in the Ohio River Valley.

2. Non-Ferrous Ores. Given the dominance of foreign sources for most major non-ferrous ores (except copper), the principal role of waterborne transportation for this commodity is as a mode of import (18.5-22.5 million short tons per year from 1969-1977). Due to the transportation cost savings involved, a large fraction of the imported ore is processed in port, reducing its bulk (bauxite to alumina and possibly to aluminum metal) and/or changing its identity (manganese to ferromanganese). About 10%-12% of non-ferrous ore imports are further distributed by water, with about 75% of the domestic traffic moving from Lower Mississippi River ports to inland river destinations (especially in the Ohio River area), and a smaller amount up the Warrior River from Mobile.

(b) Factors Affecting Modal Choice

Modal choice is almost entirely cost-based for metallic ores, with the current modal choice for any given market pattern tending to dominate alternatives by a relatively wide margin even when additional water-related stockpiling and transfer costs are included. Modal complimentarity in moving ore from mine to plant (e.g., rail from mine to Lake Superior dock, vessel to Lake Erie, and rail to Pittsburgh) is much more common than effective modal competition.

Ore transportation requirements in the future will depend on the magnitude, location, and technology of steel production, but the manner in which each region obtains its ore will be reasonably stable over the next 20-30 years. Changing relative modal rates could have an impact on the share of imported iron ore which will move up by barge from the Gulf as opposed to moving West from the Atlantic by rail, but such ore will continue to be a minor source of ore for the Ohio River Valley in either case. Currently, rail from the Atlantic Coast appears to be competitive with barge

for movements into the Pittsburgh area, with modal choice dependent on factors such as the location of the sintering planting in the Pittsburgh area, the existence of corporate ore transfer facilities on the East Coast, etc. Barge delivery dominates in the Cincinnati area, on the other hand, due to longer lengths of haul for rail, and shorter ones for barge. Warrior River ore will grow with steel production in the Birmingham area, but at a slower relative rate than during the past nine years, when the barge share of Mobile imports - most of the supply for the Alabama area - grew from 39% to 82%. An increased barge share of this traffic in the future would probably require the completing of the Coosa River extension to Gadsden. A significant decrease in share is also unlikely, barring a shutdown of the river. Although rail and barge rates from Mobile to Birmingham are roughly competitive because of the additional rail move required to get from the river at Port Birmingham into the steel mills, one producer, which receives all of the barge ore, has ownership interests in the entire ore procurement system from foreign mine to plant (including a barge line and railroad), and is unlikely to relinquish control over a link in that chain for a small dollar saving.

(c) Distribution System Developments

As noted above, no major changes in modal choice for metallic ore distribution are expected during our forecast period. The South, for example, will increase its import dependence, but modal patterns of foreign and domestic ores to plants in the South will be relatively stable.

The National Waterway Study waterborne demand projections for iron ore are based on the development of anticipated direct reduced furnaces at ore consuming plants, with ore moving from mine and import port in the same form as at present. This is consistent with problems concerning the integrity of direct reduced iron during storage or long-distance transportation. If, on the other hand, direct reduced capacity were developed at mine site or port of import, a 42% reduction in the tonnage to be shipped would be realized for ore going into the direct reduced process. This would directly impact the waterborne demand projections described below. While this contingency is not currently anticipated, its occurrence is most likely for import ore, with reduction taking place overseas or at the United States

Gulf based on cheap natural gas sources. Coal-based reduction, which is most probably for domestic ore, is more likely to occur at ore consuming plants in the vicinity of metallurgical coal supplies.

Season extension on the Great Lakes could also impact ore distribution systems in the future by potentially reducing the costs of Lakes ore transportation and expanding the capacity of future possible constraint points on the Lakes. This could have the effect of improving the market position of domestic Lake Superior ore, particularly if season extension did not include the Saint Lawrence Seaway.

WATERBORNE DEMAND PROJECTIONS

The demand for waterborne transportation of metallic ores is built up from separate forecasts of iron ore and non-ferrous ores. Iron ore flows are projected based on the growth of consumption for each steel producing region and the market share of each of seven ore producing areas (four domestic and three foreign) in the consumption of each region. Modal splits within specific origin-to-destination markets are stable over the forecast period, although changes in regional consumption rates and ore sources affect overall mode splits. As noted above, waterborne non-ferrous ores are predominately foreign trade oriented and are projected directly from forecasts described earlier.

(a) Summary

Domestic waterborne traffic demand grows from 52.4 million tons in the strike-depressed year of 1977 to 98.1 million tons in 1990 (5% per year growth) and then to 137.4 million tons during the second half of the forecast period (2.6% per year). This growth is dominated by iron ore, which constitutes 95% of the tonnage and grows from 50 million tons in 1977 to 133.9 million tons in 2003. Domestic non-ferrous ore flows grow by 1.6% per year to 1990 and 1.3% beyond, with growth rates depressed by continued increases in the concentration of ore imports.

Waterborne imports of metallic ores grow from 59.6 million tons in 1977 to 71.9 million tons in 1990 (1.5% per

year), and to 100.5 million tons in 2003 (2.6% per year after 1990). Iron ore imports, which were buoyed by the strike in 1977, grow at 1.2% per year to 1990 (compared to 1.9% for non-ferrous ores) and 3.0% per year after 1990 (1.7% for non-ferrous).

Metallic ore exports increase from 3.3 million tons in 1977 to 5.0 million tons in 2003. Most of this growth occurs at the beginning of the period, because iron ore exports, which are projected to be flat in the future, return to normal levels after the strike of 1977.

(b) Major Market Shifts

In general, the demand for domestic waterborne metallic ore transportation is projected to grow somewhat faster than iron ore consumption because the stagnation of iron ore production in the South leads to increased imports and subsequent barge delivery to plants in that region. Similarly, the shut-down of ore production in the Northeast leads to some substitution of Lake Superior ore and Great Lakes transportation. Finally, the recovery of domestic mining in the Lake Superior region in the beginning of the projection period causes a rapid increase in Lakes transportation and a related fall-off of imports.

Relatively slow projected growth of iron-ore requirements in the Cincinnati area and non-ferrous ore imports, both of which stimulate the demand for inland barge movements out of Lower Mississippi River ports, leads to slower-than-average growth in metallic ores demand on the Mississippi and Ohio Rivers.

(c) Waterborne Flow Changes

Tables III-2 through III-5 present the waterborne demand projections for metallic ores. Table III-2 shows the domestic shipments and receipts for each of 21 reporting segments. Table III-3 presents the domestic tonnage utilizing each segment within the Mississippi River system and Great Lakes, including inbound, outbound, local, and through traffic. No total is presented in this table because of the implicit double-counting of flows utilizing more than one

segment. Table III-4 exhibits the ton-miles generated on each segment for the traffic loading represented in the previous table. Ton-miles in 1977 may differ from data published elsewhere due to the level of aggregation of the National Waterway Study network used to generate distances. Projected ton-miles growth rates should be unaffected. Finally, Table III-5 shows the projected metallic ore import-export activity for each National Waterway Study reporting segment. The large tonnage for the Illinois River represents receipts at steel plants just off of Lake Michigan in the Calumet River area.

As shown in Table III-2, and noted above, domestic shipments from the Great Lakes segment jumped markedly early in the forecast period (23 million tons between 1977 and 1980) due to a return to normalcy following low shipments during a strike in 1977. Strong growth in Southern ore consumption as well as a growing share of import ore in that region drive domestic barge traffic on the Warrior River System and Atlantic Intracoastal Waterway in the Carolinas Segment (about 4% per year between 1977 and 1990, and over 4.5% per year thereafter).

As shown in Tables III-4 and III-5, domestic metallic ore flows on the Lower Mississippi and Ohio Rivers grow at a relatively modest 1.7% in both tonnage and ton-mile terms throughout the forecast period, due to sluggish iron ore demand in the Ohio River Valley and slow import growth for non-ferrous ores.

Imports grow more rapidly in the South (2.2%-3.3% annually) than in other major import regions in the first half of the forecast period because of relatively rapid growth in consumption and the lack of a strike-related effect in the base year. The Gulf Coast West grows more slowly than the Warrior River (Mobile) or South Atlantic (Wilmington, North Carolina and Charleston, South Carolina) because of a relatively greater role of non-ferrous ore.

Table III-2

WATERBORNE DEMAND PROJECTIONS [illegible]
DOMESTIC TRAFFIC

COMMODITY: Metallic Ores
ALTERNATIVE: [illegible]

SEGMENT	IN/OUT	1977	1980	1985	[illegible]	[illegible]	[illegible]	[illegible]	GROWTH [illegible]	[illegible]
Upper Mississippi	Shipped	13	14	15	17	18	19	[illegible]	[illegible]	[illegible]
	Received	18	[illegible]	[illegible]	[illegible]	24	26	[illegible]	[illegible]	[illegible]
Lower Upper Mississippi	Shipped	31	33	36	39	41	44	46	[illegible]	1.3
	Received	43	45	49	52	[illegible]	58	[illegible]	[illegible]	1.2
Lower Mississippi	Shipped	1	2	2	2	2	2	2	[illegible]	1.3
	Received	92	97	107	115	122	[illegible]	[illegible]	[illegible]	[illegible]
Baton Rouge to Gulf	Shipped	2,377	2,483	2,731	2,944	3,178	3,464	3,658	[illegible]	1.7
	Received	95	100	110	117	125	134	139	1.7	1.3
Illinois River	Shipped	69	69	70	71	72	72	73	0.2	0.2
	Received	4,470	7,439	8,133	8,920	9,996	11,261	12,218	5.5	2.4
Missouri River	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	0	0	0	0	0	0	0	[illegible]	[illegible]
Ohio River	Shipped	248	260	286	306	325	347	362	1.6	1.3
	Received	1,108	1,150	1,267	1,377	1,513	1,685	1,813	[illegible]	2.1
Tennessee River	Shipped	16	17	19	21	22	23	24	[illegible]	1.3
	Received	465	493	535	578	615	658	687	[illegible]	1.3
Arkansas River	Shipped	0	0	0	0	0	0	0	[illegible]	[illegible]
	Received	755	795	876	940	1,000	1,070	[illegible]	[illegible]	1.3
Gulf Coast West	Shipped	78	82	91	97	104	111	116	[illegible]	1.3
	Received	105	110	119	127	134	142	148	1.5	1.2
Gulf Coast East	Shipped	121	128	141	151	161	172	179	[illegible]	1.3
	Received	62	65	72	77	82	88	92	[illegible]	[illegible]
Warrior River System	Shipped	3,693	3,737	4,043	6,081	7,958	9,704	11,069	[illegible]	[illegible]
	Received	3,716	3,760	4,065	6,103	7,979	9,724	11,069	[illegible]	[illegible]
South Atlantic Coast	Shipped	434	446	482	731	960	1,172	1,339	[illegible]	4.8
	Received	501	514	550	798	1,027	1,240	1,406	[illegible]	4.5
Middle Atlantic Coast	Shipped	71	71	71	71	71	71	71	[illegible]	0
	Received	3	3	3	3	3	3	3	[illegible]	0

Table III-2 (continued)

SEGMENT	IN/OUT	YEARS 1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	0	0	0	0	0	0	0	0.0	0.0
Great Lakes and Seaway	Shipped	45,198	71,265	78,770	87,595	98,511	111,294	120,778	5.2	2.5
	Received	40,917	64,022	70,846	78,895	88,746	100,276	108,411	5.2	2.5
Washington/Oregon Coast	Shipped	a	a	a	a	a	a	a	0.0	0.0
	Received	4	4	4	4	4	4	4	0.0	0.0
Columbia-Snake Willamette River	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	0	0	0	0	0	0	0	0.0	0.0
California Coast	Shipped	4	4	4	4	4	4	4	0.0	0.0
	Received	a	a	a	a	a	a	a	0.0	0.0
Alaska	Shipped	4	4	4	4	4	4	4	0.0	0.0
	Received	a	a	a	a	a	a	a	0.0	0.0
Hawaii and Pacific Territories	Shipped	a	a	a	a	a	a	a	0.0	0.0
	Received	4	4	4	4	4	4	4	0.0	0.0
Domestic Caribbean	Shipped	a	a	a	a	a	a	a	0.0	0.0
	Received	a	a	a	a	a	a	a	0.0	0.0
Total	Shipped	52,361	78,616	86,765	98,134	111,430	126,504	137,356	5.0	2.6
	Received	52,361	78,616	86,765	98,134	111,430	126,504	137,356	5.0	2.6

a = less than 500 tons

Table III-3.

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL, AND THROUGH

COMMODITY: Metallic Ores
ALTERNATIVE: TrendLong2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	33	33	36	39	42	45	46	1.7	1.1
Lower Upper Mississippi	252	265	292	312	332	355	370	1.7	1.3
Lower Mississippi	2,510	2,625	2,892	3,121	3,369	3,671	3,886	1.7	1.7
Baton Rouge to Gulf	2,665	2,786	3,065	3,303	3,559	3,872	4,093	1.7	1.7
Illinois River	4,584	7,559	8,266	9,063	10,148	11,423	12,388	5.4	2.4
Missouri River	0	0	0	0	0	0	0	0.0	0.0
Ohio River	1,641	1,710	1,883	2,037	2,215	2,436	2,597	1.7	1.9
Tennessee River	471	496	546	586	624	667	696	1.7	1.3
Arkansas River	755	795	876	940	1,000	1,070	1,117	1.7	1.3
Gulf Coast West	181	190	207	221	235	250	260	1.6	1.2
Gulf Coast East	254	265	289	308	326	347	360	1.5	1.2
Warrior River System	3,742	3,787	4,095	6,135	8,013	9,760	11,127	3.9	4.7
Great Lakes	45,299	71,371	78,886	87,720	98,644	111,437	120,528	5.2	2.5

a = less than 500 tons

Table III-4

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON MILES
MISSISSIPPI RIVER SYSTEM GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY Metallic Ores
ALTERNATIVE TrendLong2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
Upper Mississippi	11	11	12	13	14	15	16	1.7	1.3
Lower Upper Mississippi	53	55	61	65	69	74	77	1.7	1.3
Lower Mississippi	1,469	1,534	1,690	1,826	1,976	2,162	2,294	1.7	1.8
Baton Rouge to Gulf	288	331	331	356	384	417	441	1.7	1.7
Illinois River	145	222	243	265	295	330	356	4.7	2.3
Missouri River	0	0	0	0	0	0	0	0.0	0.0
Ohio River	1,003	1,045	1,159	1,256	1,371	1,521	1,632	1.8	2.0
Tennessee River	56	59	65	70	75	80	83	1.7	1.3
Arkansas River	90	95	104	112	119	127	133	1.7	1.3
Gulf Coast West	37	38	42	45	48	51	54	1.7	1.3
Gulf Coast East	12	12	13	14	14	15	15	1.1	1.0
Warrior River System	1,354	1,370	1,482	2,231	2,921	3,563	4,065	3.9	4.[illegible]
Great Lakes	33,507	52,553	58,170	64,756	72,873	82,369	89,074	5.2	2.5
Total	38,023	57,295	63,373	71,010	80,160	90,725	98,240	4.9	2.5

a = less than 500,000 ton miles

Table III-5

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY Metallic Ores
ALTERNATIVE TrendLong2003A

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	97	102	111	121	132	143	150	1.7	1.7
	Imports	8,049	8,391	9,452	10,238	11,072	12,155	12,327	1.9	1.8
Illinois River	Exports	8	8	8	8	1	1	1	1.7	1.7
	Imports	1,239	993	1,089	1,195	1,336	1,503	1,629	0.3	2.4
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	9	9	10	11	12	13	13	1.7	1.6
	Imports	8,047	8,370	9,407	10,683	11,923	13,330	14,157	2.2	2.3
Gulf Coast East	Exports	112	118	128	139	151	164	173	1.7	1.7
	Imports	204	213	240	260	280	302	325	1.9	1.7
Warrior River System	Exports	1	1	1	2	2	2	2	1.7	1.7
	Imports	6,683	6,838	7,512	10,212	12,720	15,134	16,999	3.3	4.0
South Atlantic Coast	Exports	38	40	43	47	51	55	58	1.7	1.7
	Imports	1,144	1,177	1,303	1,671	2,017	2,359	2,621	3.0	3.5
Middle Atlantic Coast	Exports	170	129	140	153	166	180	189	0.8	1.7
	Imports	14,439	11,115	13,024	14,522	16,472	18,602	19,745	0.0	2.4

Table III-5 (continued)

SEGMENT	EXP/IMP	1977	[illegible]	1985	YEARS [illegible]	1995	[illegible]	[illegible]	% Growth [illegible]	[illegible]
North Atlantic Coast	Exports	1 *	1	1	1	1	1	1	[illegible]	[illegible]
	Imports	13	13	15	16	19	19	21	1	[illegible]
Great Lakes and Seaway	Exports	2,396	3,594	3,597	3,611	3,62[illegible]	3,6[illegible]	3,6[illegible]	1.2	[illegible]
	Imports	18,073	17,300	19,254	21,54[illegible]	24,[illegible]	[illegible]	[illegible]	1.4	[illegible]
Washington/Oregon Coast	Exports	1	1	1	1	1	1	1	1.7	1.7
	Imports	114	119	135	146	15[illegible]	172	187	1.9	1.7
Columbia Snake Willamette River	Exports	a	a	a	a	a	a	a	1.7	1.7
	Imports	85	126	148	166	183	206	220	5.1	2.2
California Coast	Exports	58	62	67	73	79	85	89	1.[illegible]	1.6
	Imports	349	626	749	849	943	1,074	1,153	7.1	2.4
Alaska	Exports	460	484	526	572	621	675	710	1.7	1.7
	Imports	a	a	a	a	a	a	a	0.0	0.0
Hawaii and Pacific Territories	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
omestic Caribbean	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	1,147	1,198	1,354	1,465	1,579	1,726	1,929	1.9	1.7
Total	Exports	3,743	4,531	4,627	4,730	4,843	4,96[illegible]	5,043	2.7	0.5
	Imports	59,586	56,479	63,682	72,963	82,997	94,1[illegible]	101,823	1.6	2.6

a = less than 500 tons

IV - COAL

INDUSTRY OUTLOOK

The Coal Industry Model is solved using both general energy forecasts and coal specific forecasts. Regional fuel demands are first solved for 13 demand regions (see Figure IV-1) for each of five energy-consuming sectors: utilities, industrial (steam and coking), residential and commercial, synfuels, and exports. The Coal Industry Model is then solved by incorporating these fuel demands into the model along with cost parameters (transportation, scrubbing, and mining), taxes (state and federal), producers rate of return, regional Btu content of coal, regional reclamation costs, and productivity changes. End products of the solved model include a forecast of coal production by supply region (six supply regions; see Figure IV-2), prices and regional flows. Small producing areas such as Missouri, Kansas, and Iowa are excluded in the interest of keeping the model simple and are assumed not to greatly distort the results. The lignite regions of Texas and North Dakota are also excluded based on the knowledge that the coal is only used locally due to its low heating value. Demand which is satisfied by this coal is netted out from the model. The national results are simply summations of the regional results.

(a) Industry Background

The coal industry has, historically, been the "sleeping giant" of energy with billions of tons of reserves evident in this country alone. Despite this fact, there has been a continued reliance on imported oil for generating electricity over the last ten years, due to its relative inexpensiveness with respect to coal (until recently). Coal has largely been used in this country to fuel electric generating plants in the states which produce large amounts of the substance (Illinois, Indiana, Alabama, Pennsylvania, Ohio, West Virginia, Virginia, Tennessee, Kentucky, Montana, and Wyoming). Coal is also used in the production of coke by steel mills but has historically represented only 16.6% of total coal consumption, on average. In 1977, United States coal consumption (both bituminous and lignite) totaled 708.4 million standard tons (22.0 million Btu = 1.0 standard ton), 77.4% of which was consumed by electric utilities and 12.6% by coke producers. The remainder was

Figure IV-1

ENERGY DEMAND REGIONS

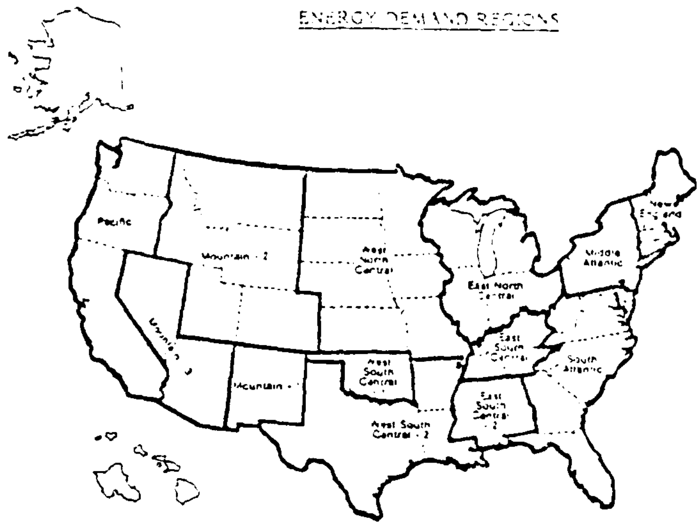
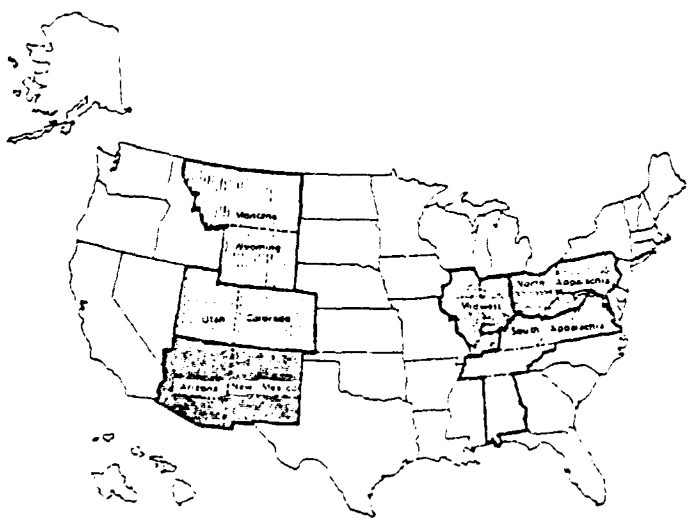


Figure IV-2

COAL SUPPLY REGIONS



used for residential purposes and exports. Utilities have increased their share of total coal consumption from 54.1% in 1965 to 78.6% in 1978, a 45% jump in 14 years (3.2% simple annual growth). Meanwhile, consumption of coal for coke has declined from 20.9% of total consumption in 1965 to 11.0% in 1978.

Along with the growth in utility consumption of coal, western coal has been making inroads on the production side. Western coal production has gone from a 9.3% market share in 1969 to 20.3% in 1977 and 21.8% in 1979 (preliminary estimates). Although western coal is low in Btu content (averaging 10,000 btu/ton), this coal also has a low sulfur content (averaging close to 0.9%), making it attractive to burn in areas with strict environmental regulations. Western coal production has also benefitted recently, in competitive terms, by environmental mining regulations which call for land reclamation after mining. Although expensive, it is easier to reclaim the rolling lands typically found in western strip mining operations than the mountainous terrain of Appalachian mines. In addition, large coal reserves are available in the West while South Appalachia is facing declining reserves. All of these factors have contributed to the significant increase over the last 14 years of western coal production and consumption.

(b) National and Regional Forecasts

As seen in Table IV-1, total supply of bituminous coal will grow from 662.5 million tons in 1977 to 1940.3 million tons in 2003 under the TRENDLONG2003A scenario. Demand for bituminous and lignite coal will also almost triple from 1977 to 2003, growing from 708.4 million tons to 1956.9 million tons. Annual compound growth rates for demand will average 5.9% from 1977 to 1990 and 3.1% from 1990 to 2003. Supply will grow at a slightly slower growth rate from 1977 to 1990 - 5.1% - but will average 3.3% growth from 1990 to 2003. The shortfall of coal supply for total demand will be made up from imports and lignite production not included in total supply.

Exports are forecast to almost double over the 26-year period, growing from 53.9 million tons in 1977 to 103.2 million tons in 2003. This growth is largely based on historical growth rates for metallurgical coal exports and does not

include significant levels of steam coal exports. Although the United States is a net exporter of coal, there is still some demand for imported coal because a special quality of coal is needed in some cases and can only come from overseas. In addition, transportation costs can be competitive to some places, such as Florida, from overseas countries such as Poland. Imports will grow from 1.7 million tons in 1977 to 3.4 million tons in 1990, an average annual growth rate of 4.9% (coal imports in 1977 were somewhat lower than they were both in 1976 and 1978 so that the base year is not truly representative of historical trends). From 1990, imports will dip in 1995, rebound in 2000 to 3.5 million tons and remain at 3.5 million through 2003. The fairly constant tonnage displayed by imports is typical of the special needs it is used for in this country.

Regionally, the majority of growth in coal demand will be found in the regions presently dependent on oil or gas - New England, West South Central 1 and 2, Mountain 1, 2, and 3, and Pacific. New England displays the largest average annual growth from 1977 to 1990 at 20.0% per year while West South Central 1 follows closely behind at 18.5% growth per year during the same period. The Pacific region averages 15.1% annual demand growth from 1977 to 1990 while West South Central 2 averages close to 10.0% annual growth and the three Mountain regions average between 7.6% and 8.6% annual growth from 1977 to 1990. The remaining regions (Middle Atlantic, South Atlantic, East North Central, East South Central 1 and 2, and West North Central) will experience average annual growth rates of between 3.3% (East South Central 1) and 7.2% (West North Central). During the period 1990 to 2003, demand is expected to slow down for all regions, generally averaging growth rates which are half of the 1977 to 1990 rates, except the East South Central 1 growth rate which will increase to 4.3% annually from 1990 to 2003.

The percent of demand which is attributed to utilities remains fairly constant for all except Mountain 1 where the utility share of total demand falls from 96.3% in 1977 to 54.4% in 2003 and in the Pacific where the utility share increases from 48.5% in 1977 to 79.4% in 2003. Utility share will drop during the 26-year period in the Mountain 1 and 3 regions due to an increasing share of coal being used for synthetic fuel development rather than power generation. In the Pacific, on the other hand, the small amount of coal

Table IV-1

COAL INDUSTRY FORECASTS
Scenario TrendLong2003A

(Thousands of Tons)

	1977	1980	1985	1990	1995	2000	2003	% Annual Compound Growth 1977 To 1990	% Annual Compound Growth 1990 To 2003
DEMAND FOR BITUMINOUS AND LIGNITE COAL									
New England	1,309.7	2,224.6	4,525.6	8,753.9	13,653.0	18,200.2	22,331.3	20.0	7.3
%Utility	88.4	91.4	93.6	97.1	98.3	98.1	98.0	0.5	0.0
Middle Atlantic	88,365.0	100,373.1	127,125.5	136,806.9	170,920.5	193,022.2	200,559.3	5.2	2.5
%Utility	56.2	58.4	59.0	62.6	65.0	62.7	60.9	0.8	-0.3
South Atlantic	159,361.1	166,519.2	210,012.5	262,565.3	310,311.9	354,019.8	379,604.6	5.1	[illegible]
%Utility	61.0	59.7	59.3	63.6	66.7	65.7	64.1	-0.3	0.1
East North Central	231,950.6	249,071.1	302,295.3	373,094.4	413,550.4	461,616.0	499,392.4	4.9	2.1
%Utility	63.3	60.6	57.6	64.2	65.0	62.2	59.2	-0.2	0.7
East South Central 1	54,704.0	58,399.0	59,331.8	75,915.7	93,760.8	116,665.3	132,489.2	3.3	4.3
%Utility	86.6	85.3	79.7	81.6	82.3	80.9	79.9	-0.8	-0.2
East South Central 2	15,207.1	35,476.3	41,711.9	56,490.7	67,921.2	78,512.2	84,220.0	5.6	3.0
%Utility	67.5	67.6	61.6	67.8	67.8	65.5	63.4	0.3	0.5
West North Central	60,150.0	72,334.6	103,909.3	136,900.6	160,073.5	193,452.4	199,045.7	7.2	2.8
%Utility	86.3	85.9	86.2	89.5	90.4	89.5	87.0	0.0	0.2
West South Central 1	1,501.3	2,805.3	8,055.2	12,734.2	19,163.1	25,0[illegible]3.1	28,780.9	18.5	6.0
%Utility	92.7	94.8	93.9	86.6	91.7	84.1	83.9	0.9	0.3
West South Central 2	16,436.2	30,748.9	43,261.0	67,992.9	92,422.6	118,233.4	133,571.2	10.0	5.5
%Utility	74.1	83.1	80.1	80.2	83.5	83.2	89.6	0.2	0.1
Mountain 1	7,452.0	9,121.4	12,256.9	17,351.7	20,159.9	22,209.5	23,645.3	8.1	2.3
%Utility	96.3	98.0	93.4	77.5	66.2	58.4	53.4	-2.0	-2.7
Mountain 2	28,716.1	33,967.8	42,825.9	66,345.7	81,599.4	93,263.4	101,321.1	7.6	3.3
%Utility	77.2	78.1	78.6	80.2	79.8	77.1	75.4	0.0	0.5
Mountain 3	13,194.1	15,112.1	21,917.5	31,185.6	39,391.1	47,421.8	52,249.7	8.6	4.0
%Utility	94.1	94.9	92.7	85.5	80.9	78.4	77.1	-1.1	-0.8
Pacific	6,906.7	7,950.9	15,233.9	35,371.2	58,412.9	80,341.0	92,524.3	15.1	7.1
%Utility	40.5	42.8	59.3	74.1	[illegible]	79.6	79.4	2.8	0.5
TOTAL DEMAND	708,427.3	784,994.1	1,002,945.1	1,287,500.8	1,541,573.6	1,795,313.2	1,956,969.1	5.9	3.1
%Utility	67.5	67.4	66.2	71.1	71.1	71.4	69.8	0.0	0.2
PRODUCTION OF BITUMINOUS COAL									
North Appalachia	174,812.4	171,085.6	165,640.8	211,021.9	249,648.1	272,002.6	302,290.2	1.5	2.8
South Appalachia	220,998.7	229,276.2	256,414.7	265,307.4	249,166.4	236,706.6	234,197.2	1.4	0.6
Midwest	136,023.0	126,330.7	156,086.7	218,109.2	315,305.9	375,211.6	432,208.5	3.7	5.4
Montana Wyoming	85,171.6	151,002.7	261,429.4	412,377.5	512,138.3	610,365.2	703,413.3	12.9	4.2
Colorado Utah	22,558.1	31,131.2	80,935.7	86,079.0	83,610.9	112,232.8	129,639.7	10.8	3.2
Arizona New Mexico	22,948.5	39,226.6	47,728.5	75,167.9	106,118.2	1[illegible]	1[illegible]	9.6	4.2
TOTAL SUPPLY	667,512.1	748,053.2	969,265.7	1,268,062.9	1,521,229.8	1,799,250.2	1,940,222.8	5.1	3.3
EXPORTS	53,917.6	55,493.6	70,697.5	81,501.2	83,241.3	97,711.8	103,173.2	3.2	1.8
IMPORTS	1,721.7	3,030.5	3,136.5	3,416.0	3,382.6	3,456.7	3,456.7	4.9	-0.3

NOTE: DEMAND TONNAGE IS IN STANDARD TONS.
ONE STANDARD TON EQUALS 22.0 MILLION BTU.

now consumed is for industrial and residential purposes while the incremental demand during the forecast period will largely be used by converted oil plants or new coal plants.

Supply will grow most rapidly in the western producing regions with Montana - Wyoming leading the way, averaging 12.9% annual growth rates from 1977 to 1990. North Appalachia and South Appalachia will average 1.4% to 1.5% annual growth while the Midwest will fare somewhat better at 3.7% average annual growth from 1977 to 1990. During the next decade, however, there should be a resurgence in demand for more local coal which will benefit North Appalachia and the Midwest (South Appalachian coal reserves are expected to begin deterioration by this time, thus explaining the 0.6% average annual decline in supply).

Demand and supply will fall an average of 0.05% to 0.61% per year under the BADENERGY2003A and the LARGERGOVT2003A scenarios. The decline under BADENERGY2003A is largely due to an overall decline in the quantity of energy demanded because of higher prices while a further decline under LARGERGOVT2003A is a result of a general economic slowdown expected to occur under this scenario.

(c) Key Industry Developments

Assumptions are made for a number of key parameters within the Coal Industry Model including nominal rates of change for transportation (7.7% for East originations and 8.8% for West originations), scrubbing (6.6%), mining machinery (6.9%), and mining wages (9.3%). Also assumed within the model are state and federal taxes, real rate of return (10.0%), the Btu content of each supply region's coal, regional reclamation costs for surface mining ($5.70-$7.04 per ton in the East opposed to $0.74-$0.96 per ton in the West), and the compound annual rate of change for productivity, both surface and deep mining. These assumptions are made based on knowledge of the industry as well as on historical experiences. These assumptions are key inputs for the results discussed above.

Although utilities will continue to constitute the largest sector of coal demand, recently developed synthetic

fuel production processes from coal will open up an entirely new market for the coal industry. Production of bituminous coal for synthetic fuel producers in 2003 will be 8.3% of total production. Should a nuclear moratorium occur, total production of bituminous coal will increase by another 11.2% in 2003. This phenomenon is not considered in any of the three macroeconomic scenarios and could be considered one risk of the forecast. Another risk of the forecast is that the export forecast may be low in light of the recent speculation that foreign demand for steam coal may increase significantly due to the high price of oil.

In a very real sense, the future of coal producers lies in the expectation that oil prices will continue to spiral upward and environmental problems associated with burning coal can be solved. The longer prices increase significantly, the more competitive coal will be in the fuel market (both domestically and foreign), despite environmental constraints. As in the case of most commodities, the coal that is produced must be transported to the market. The following two sections deal with the waterborne transportation of coal, the first section includes a description of historical waterborne coal flow patterns while the second includes a presentation and analysis of the National Waterway Study projections for coal.

DISTRIBUTION SYSTEMS

Historical coal movements among regions have been characterized by "minimum-distance" flows. Until a few years ago, coal transportation rates were a substantial portion of final delivered prices, making use of nearest coal supplies to a utility most likely. Presently, however, only New England and Middle Atlantic states are actually receiving the majority of their coal from the nearest coal supply regions. A number of factors have contributed to the increasing distances between coal supplier and user. For example, strict air pollution regulations in the East North Central region forced a number of utilities to seek low-sulfur coal in the West, rather than using untried (at the time) coal scrubbing technologies on local, high-sulfur coal. In the West North Central region, western coal has become popular due to lower mining costs that allow shipments over greater distances (in this case, well over 500 miles) while still being competitive with midwestern coal on the basis of delivered prices. Finally, the economics of

coal transportation have changed rapidly over the last decade. The introduction of rail unit trains and integrated barge tows of coal have reduced per unit transit costs dramatically. In addition, joint rail/barge rates have extended the competitive range of western coal, especially by using the best of each transportation mode; the unit train in the water-inaccessible West coupled with barge in the complex and congested eastern rail areas.

(a) Role of Water Transportation

Barge (or vessel) delivered coal generally terminates at electric utility plants situated on the major internal waterways as well as on the Great Lakes, the Gulf Coast, and the Atlantic Coast. Steel plants in Pennsylvania, West Virginia, and Ohio, also receive coal by barge but utilities are by far the largest recipients of coal barge deliveries. In 1977, almost 23% of all coal shipments had some movement by water; approximately 78% of that tonnage was delivered to electric utilities.

Water transportation of coal to these electricity generating units is typically short-haul, in most cases no more than 100 miles, and is usually preceded by a truck or rail move to the river loading site. Examples of typical waterborne coal movements include:

1. Coal is loaded into barges on the Ohio River in Uniontown, Kentucky, and then moved downstream onto the Mississippi for final delivery to the Tennessee Valley Authority's Allen plant in Memphis, Tennessee;

2. Alabama Power's Barry plant received 78% of its coal in 1977 from Alabama coal fields. The coal is delivered to the utility's transloading facilities in Gorgas, Alabama, by truck and conveyor. The coal then moves downstream in barges on the Tombigbee River to the plant's site in Bucks, Alabama;

3. Western coal for Upper Mississippi plants which receive coal by barge (Black Dog, Allan King, Alma, Stoneman, Lansing, Nelson Dewey, Meramec, and a number of others) is typically transloaded from Burlington Northern unit trains in St. Paul/Minneapolis, Minnesota, and moved by barge anywhere from 20 miles to 350 miles downstream; and

5. Coal destined for delivery to plants situated on the Ohio River is typically eastern coal, brought to loading facilities in West Virginia, Ohio, Kentucky, Illinois, and Indiana by railroad or truck. The only exception to this trend has been the Gavin plant of Ohio Electric in Gallipolis, Ohio. This plant received western coal which was loaded into barges at Metropolis, Illinois, from unit trains for final delivery.

A water movement which is atypical is the rail-to-barge-to-rail movement utilized by the Georgia Power Company. Coal is transloaded from Louisville and Nashville railcars into barges on the Tennessee River at Grand Rivers, Kentucky. The coal is then translocated from the barges back onto railcars in Pride, Alabama, after the coal has been blended at the utility's blending facility in Pride.

(b) Factors Affecting Modal Choice

What kind of factors go into making a decision such as Georgia Power Company's to utilize a three step coal delivery process? In that company's case, it is simply economics. They are tied into a long-term contract for high-sulfur coal which they cannot now burn until it has been blended with a lower-sulfur coal. The rail-to-barge-to-rail process is the most economical way for the utility to achieve the correct blend of coal and get it to the plant.

In most cases, economics are the overriding factors for a plant's decision to receive coal by barge, if that plant is located on the water. Except in the case of one utility, all of the plants presently receiving coal by barge will, in all likelihood, continue to do so because the investment has been made in the barge unloading facilities. Very often only marginal rail links exist at these facilities, if any link at all, thereby necessitating barge or truck delivery exclusively. Kentucky Utilities is one utility which is investigating construction of rail facilities for its Ghent plant; the decision has largely been based on the fact that two new units will be added by 1983, thereby doubling coal consumption at the plant, and making rail delivery a more attractive alternative. The investment needed for construction of a rail link and rail unloading facilities, in the majority of cases, however, is largely prohibitive if

barge facilities are in good condition and do not need significant capacity added to their capabilities.

In addition to investment and existing facility considerations, another factor affecting modal decisions is the utility's coal source. A shift to western coal by utilities on the Mississippi River will help accelerate the slowing in barge deliveries to facilities in this region in favor of direct rail delivery, thereby eliminating the transloading costs. The majority of new coal fired plants in this region will, in most cases, locate off the river for this reason. Another example of the impact of coal sources on the modal decision is with respect to some facilities along the Ohio River. For these facilities, a difference of as little as ten miles in a coal source could result in a shift from coal delivered by barge to coal delivered by truck. This shift can be made with relative ease due to the fact that truck delivered coal does not require special unloading facilities - only a stockpile to dump the coal. Coal trucks typically travel only short distances so that the coal source must be close by. If a facility is not on a barge-served river and is not within approximately 50 miles of its coal source, railroad is usually the only modal choice left for the facility (unless it is a mine mouth facility). In general, the modal decision for new plants is made in advance of construction so that site and mode are compatible and cost effective. Many utilities favor final delivery by water, when feasible, based on a lower ton-mile cost and the ability to contract a barge rate whereas rail rates cannot be contracted now. It is not, however, always feasible to locate on the waterways.

(c) Distribution System Developments

As mentioned in the preceeding section, one development that is expected to come about in the distribution of coal is that utilities in West North Central and East North Central states which border the Mississippi River will begin locating off the river. The reasoning for this location decision largely hinges on the fact that these utilities will be consuming western coal which must initially be moved by railroad. In order to avoid the costs of transloading from rail to barge, the utilities will locate where direct rail service can be accomplished with relative ease.

New coal flows which are expected to evolve on the waterways include delivery of both eastern and western coal to synthetic fuel plants located on the Mississippi River and the Gulf of Mexico, near refineries and chemical plants. Synthetic fuel plants which could receive coal by barge may total as many as ten, each consuming five million tons of coal per year to produce the equivalent of 30,000 barrels of oil per day per plant. The logistics involved in synthetic fuel plant location for this study will be discussed in more detail in the following section.

A third potential impact on the waterborne distribution of coal involves the ability of coal slurry pipelines to compete with rail/barge delivery of coal. A number of proposals could directly compete with waterborne coal deliveries to West South Central and East South Central utilities. The two lines which would pose the most substantial competition to existing modal patterns are the Energy Transportation System, Inc. (ETSI) and the Florida Gas pipelines. The ETSI pipeline is currently being designed to run from the Powder River Basin region in Wyoming south to Mississippi while the Florida Gas line is being considered as a two source line (Southern Illinois and Indiana as one source and East Kentucky and West Virginia as the second source), terminating in Florida. By 2003, capacity of the ETSI line could reach 38 million tons, using 42-inch diameter pipe. The Florida Gas pipeline could reach an annual capacity of 40 million tons in 2003. Theoretically, therefore, these pipelines could draw 78 million tons of coal away from the railroads and barge operators on traditional as well as new coal movements.

WATERBORNE DEMAND PROJECTIONS

Waterborne coal traffic was projected by using coal demand by region as the primary explanatory variable. An analysis was performed to determine both the relevant demand region being served by the particular waterway segment as well as the overriding usage in that region for the coal (i.e., utility, coke, industrial, etc.). When these two factors were determined for 18 "super segments," equations were solved using the correct demand factors as well as inventory change considerations, demand for petroleum by electric utilities, and consideration for changing barge market shares as well as for strikes and weather problems.

The resultant equations were used to solve coal terminations on the 18 "super segments" from 1978 to 2003. These results were then allocated to the 67 analysis segments based on 1977 shares. While most origination patterns were left intact, based on the knowledge that most flows are contracted for long periods of time, some origination shifts were made manually within the projection. These source changes took the form of allocating incremental coal flows to a certain segment source as opposed to the traditional origination. Examples of these source shifts include:

1. More tonnage loaded on the Upper Mississippi for termination on the Upper Mississippi to reflect increased western flows;

2. More tonnage loaded below Locks and Dam 26 for termination on the Lower Mississippi - Baton Rouge to Gulf - to reflect both increased western flows to utilities and synthetic fuel plants as well as increased exports through the Gulf;

3. More tonnage loaded onto the Tennessee River after 1990 to reflect usage of the Tennessee-Tombigbee Waterway for terminations on the Black Warrior River and the Florida Gulf Coast;

4. A shift to loading western coal at Duluth-Superior on Lake Superior for final delivery to users on the Great Lakes, reflecting the installation of a transloader at this port; and

5. A shift to loading low-sulfur eastern coal onto Ohio River segments for final delivery on the Ohio River.

The results of this allocation were then included in the projection, producing waterborne coal traffic flows for the forecast years (1980, 1985, 1990, 1995, 2000, and 2003) and for each scenario (TRENDLONG2003A, BADENERGY2003A, and LARGERGOVT2003A).

(a) Summary

Total traffic, shipped or received from a domestic water segment, will grow at an average annual rate of growth of 4.5% from 1977 to 1990. Total domestic coal traffic

shipped or received from 1990 to 2003 will grow at an average annual rate of 3.2%. Total exports will grow 3.6% per year from 1977 to 1990 and 1.8% per year from 1990 to 2003. Imports will grow most substantially from 1977 to 1990, averaging 5.4% annual growth, but will grind to a standstill for the period 1990 to 2003, averaging only 0.1% growth per year over the 14 year period.

The Ohio River system is, by far, the predominant waterway segment for domestic coal traffic. Both steam coal for electric utilities and metallurgical coal for steel plants are shipped and received on this segment. Shipments will grow at a slightly faster rate than receipts from 1977 to 1990 - 3.9% as opposed to 3.0% per year - as well as from 1990 to 2003 - 2.9% as opposed to 1.9%. This is largely attributable to significantly increased demands by facilities on other segments (most notably the Lower Mississippi River segments and the Gulf Coast Waterway segments). Coal which is easily loaded onto the Ohio River (and its tributaries) and moved along the inland waterway network will supply a large share of these increased demands. In addition to the Ohio River segment growth, shipments and receipts on the Middle Atlantic Coast will also grow significantly in an attempt to meet new coal demands along this segment and into the North Atlantic Coast segment. Specific causes for coal shipment and receipt growth rates on the major waterway segments will be discussed in the following two secitons.

(b) Major Market Shifts

As seen in Table IV-2, shipments of coal on the Upper Mississippi River will grow an average of 10.9% per year from 1977 to 1990 and 3.3% per year from 1990 to 2003. These growth rates are substantially higher than the total growth rates referred to in the preceeding section and represent a shift to loading western coal onto the Mississippi River at upper river points. Coal receipt growth rates for the Upper Mississippi are significantly below the average for all segments from 1990 to 2003, indicative of the shift to rail delivery of western coal to plants located in the regions historically served by the segment.

Increased conversion of New England and Middle Atlantic electric utilities from oil-fired boilers to coal-fired boilers will result in substantial growth rates for Middle Atlantic Coast coal shipments and receipts. From 1977 to 1990, shipments from this segment for domestic termination will grow at an average annual rate of 11.9% while receipts for the same time frame will grow an average of 10.7% per year. Growth rates will slow to more than half these rates during the period 1990 to 2003 with shipments from the Middle Atlantic Coast averaging 5.0% growth per year and receipts averaging 5.5% growth per year.

Another market shift which is manifested in the waterborne demand projections is export growth out of the Gulf as opposed to from the East Coast. Total export tonnage originating from the Baton Rouge to Gulf segment will grow an average of 11.7% per year from 1977 to 1990 and 3.9% per year from 1990 to 2003 while total exports are only expected to grow at average annual rates of 3.3% and 1.7%, respectively, for the two time periods. Meanwhile, exports from the Middle Atlantic Coast will only average growth rates of 2.0% per year from 1977 to 1990 and 1.4% per year from 1990 to 2003, clearly indicating a growing shift in export activity.

(c) Waterborne Flow Developments

Tables IV-2 through IV-5 present the waterborne tonnage projections for coal by reporting segments for selected years. Table IV-2 includes total shipped and received domestic tonnages for each segment while Table IV-3 presents the numbers of tons which travel on any part of the segment. Ton-miles for each segment are highlighted in Table IV-4. Table IV-5 includes the projections for export/import tonnage by reporting segment. All of the tables present tonnages under the TRENDLONG2003A scenario; tables containing the alternate scenario projections are included in Appendix B.

Coal demand by synthetic fuel plants will represent the major new source of coal demand for the next 25 years. Although still a relatively untried technology in this country, synthetic fuel production should provide the outlet for

161 million tons of coal by 2003. Of this total, 10.0 million tons is estimated to terminate on the GIWW West, 25.0 million tons on the Baton Rouge to Gulf segment of the Mississippi River and 15.0 million tons on the Lower Upper Mississippi. In terms of plants, these figures represent two synfuel plants on the GIWW West, five plants in the Baton Rouge-Gulf area and three plants on the Lower Upper Mississippi. Each plant would produce the equivalent of approximately 30,000 barrels per day of petroleum.

Growth rates on the three segments where synthetic fuel plants are expected to locate alqng the waterways will be significantly greater than those for the total flows. For example, coal receipts on the Lower Upper Mississippi will average annual rates of growth of 12.7% for 1977 to 1990 and 5.9% from 1990 to 2003. Coal receipts on the Baton Rouge to Gulf segment will grow at an average rate of 13.7% per year from 1977 to 1990 and 6.1% per year from 1990 to 2003 as opposed to a historical growth rate of 1.7% from 1969 to 1977. The GIWW West will experience the largest growth rate of the three segments - 24.7% average annual growth from 1977 to 1990 and 6.6% average annual growth from 1990 to 2003. The majority of coal for these synthetic fuel plants will come from coal mines in the Ohio River Basin, although some will also originate in western coal fields.

As mentioned before, the Ohio River system handles the majority of coal which moves domestically. Total tonnage shipped from the segment will grow from 98.8 million tons in 1977 to 236.4 million tons in 2003 (3.3% average annual compound growth rate). Total receipts will grow from 83.0 million tons in 1977 to 156.9 million tons in 2003 (2.4% average annual compound growth) while total traffic will grow an average of 3.4% per year, increasing from 100.2 million tons in 1977 to 245.8 million tons in 2003 (see Table IV-3). Ton-miles on the Ohio River segment will grow at an average annual compound growth rate of 5.4% from 1977 to 1990 and 3.6% from 1990 to 2003.

Growth of coal shipments and receipts on the Great Lakes and St. Lawrence Seaway will be significantly slower from 1977 to 2003 with shipments averaging 2.0% per year and receipts averaging 1.9% per year. New coal demand will be slow to develop on the Great Lakes because of the shortened navigation season and the ability, in most cases, of coal

consumers to receive the substance both by railroad and vessel. Coal shipments and receipts on the West Coast from Alaska to California as well as Hawaii and the Caribbean are held constant in light of their instability and small impact with respect to the other segments considered in this study. The largest flow (46,000 tons received in Alaska) represents only 31 barge loads in 1977, quite insignificant when compared to the 65,885 barge loads shipped in 1977 from the Ohio River segment.

Again, a risk of the projections exists in the export demand projections which may be low in light of recent speculation of dramatic increases in demand by European and Asian countries. The majority of the increased export demand is expected to be for steam coal as opposed to metallurgical coal, the major type of coal exported at this time. The impact of higher levels of coal exports on waterway and port traffic is examined in detail in the evaluation and strategy phase of NWS, using alternative traffic scenarios and sensitivity analyses.

Table IV-2

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY: [illegible]
ALTERNATIVE: [illegible]

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Shipped	2,311	4,761	5,440	6,945	11,447	12,884	11,490	10.9	3.3
	Received	6,840	8,480	10,194	13,913	16,194	[illegible]	[illegible]	5.6	1.9
Lower Ohio Mississippi	Shipped	7,446	7,842	10,272	15,300	19,776	23,183	25,008	5.7	3.9
	Received	2,018	[illegible]	1,952	9,521	14,138	18,527	20,083	12.7	5.9
Lower Mississippi	Shipped	5	5	6	7	8	8	9	3.3	1.4
	Received	4,244	[illegible]	4,551	5,542	6,952	8,110	8,826	2.1	3.6
Baton Rouge to Gulf	Shipped	2,911	2,784	3,482	4,256	3,454	3,604	3,672	3.0	1.1
	Received	3,445	4,406	6,762	18,184	29,184	36,316	39,309	13.7	6.1
Illinois River	Shipped	7,457	8,432	9,615	11,070	12,492	13,334	13,699	3.1	1.7
	Received	6,138	[illegible]	8,713	10,830	12,566	13,547	13,971	4.5	2.0
Missouri River	Shipped	1	2	2	3	3	3	3	4.5	2.0
	Received	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Shipped	98,828	103,313	132,626	162,867	195,359	222,390	236,359	3.9	2.9
	Received	83,043	86,966	110,343	122,419	136,950	149,164	156,894	3.0	1.9
Tennessee River	Shipped	4,079	4,159	4,461	5,613	9,634	12,383	14,120	2.5	7.4
	Received	7,435	7,176	7,009	8,235	10,507	12,953	14,542	0.8	4.5
Arkansas River	Shipped	515	637	1,111	3,655	5,658	7,901	[illegible]	16.3	6.1
	Received	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Shipped	a	a	a	a	a	a	a	10.8	5.5
	Received	261	322	797	4,591	7,427	9,195	10,519	24.7	6.6
Gulf Coast East	Shipped	692	1,044	2,821	5,682	10,266	12,902	14,106	17.6	7.2
	Received	8,063	7,541	14,104	22,253	30,712	36,977	39,828	8.1	4.6
Warrior River System	Shipped	7,821	7,728	10,282	13,312	13,786	16,093	17,526	4.2	2.1
	Received	7,118	7,200	8,888	10,972	13,543	16,717	18,968	3.4	4.3
South Atlantic Coast	Shipped	a	a	a	a	a	a	a	2.8	2.7
	Received	2	2	2	2	2	2	2	0.0	0.0
Middle Atlantic Coast	Shipped	5,034	7,654	15,177	21,789	30,178	36,510	40,859	11.9	5.0
	Received	5,026	7,646	13,670	18,782	27,171	33,501	37,851	10.7	5.5

Table IV-2 (continued)

SEGMENT	IN/OUT	1977	[illegible]	1985	YEARS [illegible]	[illegible]	[illegible]	[illegible]	% GROWTH [illegible]	[illegible]
North Atlantic Coast	Shipped	0	0	0	0	[illegible]	0	[illegible]	[illegible]	
	Received	a	a	1,500	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Great Lakes and Seaway	Shipped	19,145	25,024	26,254	24,424	29,133	[illegible]	[illegible]	[illegible]	[illegible]
	Received	22,635	[illegible]	[illegible]	28,623	[illegible]	[illegible]	[illegible]	1.8	[illegible]
Washington Oregon Coast	Shipped	17	17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Received	1	1	1	1	1	1	1	[illegible]	
Columbia Snake Willamette River	Shipped	0	0	0	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Received	0	0	0	0	[illegible]	0	0	[illegible]	[illegible]
California Coast	Shipped	a	a	a	a	a	a	a	[illegible]	[illegible]
	Received	1	1	1	1	1	1	1	[illegible]	[illegible]
Alaska	Shipped	11	11	11	11	11	11	11	0.0	[illegible]
	Received	46	46	46	[illegible]	[illegible]	46	46	[illegible]	[illegible]
Hawaii and Pacific Territories	Shipped	0	0	[illegible]	0	[illegible]	0	[illegible]	[illegible]	[illegible]
	Received	a	a	a	a	a	[illegible]	a	[illegible]	[illegible]
Domestic Caribbean	Shipped	0	0	0	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Received	a	a	a	a	a	a	a	[illegible]	[illegible]
Total	Shipped	156,236	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Received	156,236	171,844	[illegible]	[illegible]	340,231	[illegible]	[illegible]	[illegible]	[illegible]

a = less than 500 tons

Table IV-3

WATERBORNE DEMAND PROJECTIONS [illegible]
MISSISSIPPI RIVER SYSTEM [illegible]
DOMESTIC TRAFFIC [illegible]

COMMODITY: [illegible]
ALTERNATIVE: [illegible]

Segment	1977	[illegible]	[illegible]	Year [illegible]	[illegible]	[illegible]	[illegible]	% Growth [illegible]	[illegible]
Upper Mississippi	6,872	8,532	[illegible]	15,220	18,31[illegible]	[illegible]	[illegible]	[illegible]	2.1
Lower Upper Mississippi	10,681	11,815	15,864	25,718	31,186	41,756	41,592	[illegible]	4.3
Lower Mississippi	11,936	12,160	18,[illegible]	18,784	59,[illegible]	[illegible]	82,82[illegible]	6.5	[illegible]
Baton Rouge to Gulf	10,410	10,749	[illegible]	[illegible]	55,[illegible]	[illegible]	[illegible]	[illegible]	5.8
Illinois River	9,625	10,806	13,[illegible]	15,055	17,281	18,611	19,22[illegible]	[illegible]	1.9
Missouri River	1	2	2	3	3	3	a	1.5	2.[illegible]
Ohio River	100,229	104,810	134,949	165,556	211,[illegible]	[illegible]	245,[illegible]	4.0	[illegible]
Tennessee River	8,457	8,49[illegible]	8,576	10,449	15,803	19,988	22,658	[illegible]	[illegible]
Arkansas River	515	637	1,114	3,[illegible]	5,618	7,30[illegible]	7,841	16.3	6.1
Gulf Coast West	261	222	797	4,[illegible]	7,42[illegible]	[illegible]	[illegible]	24.[illegible]	[illegible]
Gulf Coast East	8,446	7,935	14,59[illegible]	22,841	[illegible]	42,4[illegible]	[illegible]	8.[illegible]	[illegible]
Warrior River System	8,178	8,089	10,729	13,86[illegible]	17,528	21,508	[illegible]	[illegible]	4.1
Great Lakes	22,615	29,330	29,560	28,621	32,818	35,985	37,171	1.8	2.[illegible]

a = less than 500 tons

Table IV-4

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY: [illegible]
ALTERNATIVE: [illegible]

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	2,213	2,502	2,960	3,986	4,749	5,221	5,412	4.6	2.4
Lower Upper Mississippi	1,351	1,550	2,025	3,192	4,238	5,102	5,129	6.8	4.2
Lower Mississippi	5,623	5,907	10,086	22,475	35,678	45,646	[illegible]	11.2	6.1
Baton Rouge to Gulf	1,450	1,547	2,416	4,268	6,486	8,152	[illegible]	8.6	5.8
Illinois River	1,260	1,499	1,837	2,122	2,490	2,719	2,818	4.1	2.2
Missouri River	*	*	*	*	*	*	*	4.5	2.0
Ohio River	20,152	21,548	29,653	[illegible]	50,533	59,178	63,267	5.4	3.6
Tennessee River	845	881	882	1,062	1,776	2,288	2,619	1.8	7.2
Arkansas River	189	234	409	1,343	2,080	2,684	2,883	16.3	6.1
Gulf Coast West	76	86	165	791	1,260	1,651	[illegible]	[illegible]	6.4
Gulf Coast East	449	406	837	1,357	2,383	3,015	[illegible]	8.9	7.2
Warrior River System	2,134	2,144	2,716	3,789	3,548	4,195	[illegible]	1.6	2.4
Great Lakes	8,206	11,427	11,551	11,105	13,097	[illegible]	[illegible]	2.4	2.5
Total	43,959	49,731	65,525	95,002	128,318	154,418	166,139	6.1	4.4

* - less than 500,000 ton miles

Table IV-5

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY [illegible]
ALTERNATIVE [illegible]

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
[illegible] Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	1,313	2,135	4,1[illegible]	5,51[illegible]	6,8[illegible]	8,202	9,[illegible]	11.7	3.9
	Imports	142	252	[illegible]	284	[illegible]	287	287	5.5	0.1
Illinois River	Exports	12	17	21	23	26	28	30	5.3	1.8
	Imports	0	0	0	0	0	0	0	0.0	0.0
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	18	18	18	18	18	18	18	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast East	Exports	125	125	125	125	125	125	125	0.0	0.0
	Imports	219	385	398	414	425	439	439	5.4	0.1
Warrior River System	Exports	3,612	4,259	6,023	6,940	7,943	9,040	9,148	5.2	2.6
	Imports	866	1,526	1,589	1,721	1,684	1,741	1,741	5.4	0.1
South Atlantic Coast	Exports	1	1	1	1	1	1	1	0.0	0.0
	Imports	[illegible]	1	1	1	1	1	1	5.4	0.1
Middle Atlantic Coast	Exports	31,986	33,807	38,755	41,328	44,143	47,224	49,211	2.0	1.4
	Imports	306	516	555	605	5[illegible]	612	612	5.4	0.1

Table IV-5 (continued)

Segment	Direction	YEARS							% Growth	
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
North Atlantic Coast	Exports		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Imports		[illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Exports	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	34,176	4.8	[illegible]
	Imports	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5.3	[illegible]
Washington/Oregon Coast	Exports	a	a	a	a	a	a	a	[illegible]	[illegible]
	Imports	[illegible]	21	[illegible]	24	[illegible]	23	24	[illegible]	[illegible]
Columbia-Snake Willamette River	Exports	a	a	a	a	a	a	a	[illegible]	[illegible]
	Imports	a	a	a	a	a	a	a	5.0	[illegible]
California Coast	Exports	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Imports	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	315	5.4	[illegible]
Alaska	Exports	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Imports	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Hawaii and Pacific Territories	Exports	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.0	[illegible]
	Imports	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Exports	[illegible]	a	a	a	a	a	a	0.0	[illegible]
	Imports	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Total	Exports	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1.8
	Imports	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5.4	[illegible]

a - Less than 500 tons

AD-A105 701 DATA RESOURCES INC LEXINGTON MA F/G 13/10
NATIONAL WATERWAYS STUDY. TRAFFIC FORECASTING METHODOLOGY.(U)
AUG 81 D ANDERSON, R SCHUESSLER DACW72-79-C-0003

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V - CRUDE PETROLEUM

INDUSTRY OUTLOOK

The Crude Petroleum Industry Model used to perform the analysis for crude petroleum is a synthesis of two interrelated models, the Drilling Model which forecasts domestic crude petroleum and natural gas exploration, drilling and production activity based upon econometric analysis, and the Energy Model, which forecasts a comprehensive set of prices, production levels, imports and exports, supplies, and demands for several alternative energy sources; petroleum (crude and products), natural gas, coal, nuclear, hydro, solar, exotic, etc. for use in several end markets (commercial, residential, utility, industrial, transportation) for both fuel and power use and as raw materials use in 13 separate regions which can be aggregated to form either Census Regions or PAD Districts. The Energy Model uses as exogenous inputs the output of the Drilling Model, and certain other variables, and forecasts the remaining endogenous variables based on an econometric analysis of the United States energy sector of the economy.

(a) Industry Background

United States domestic production of crude petroleum in 1977 was 8.24 million barrels per day (mmbd), while imports of foreign crude were 6.5 mmbd. Total demand for crude petroleum was 14.79 mmbd. Important historical trends include a growing shortfall between domestic production and demand, with resultant increases in crude petroleum imports and decline in crude petroleum exports. Markets for crude petroleum have predominantly been in gasoline, distillate fuels, and residual fuels, with rapidly expanding markets in jet fuels, and raw materials uses of petroleum, particularly for petrochemical feedstock uses. Technology for crude petroleum production consists of exploration, drilling, and extraction, with shifts to exploring and drilling in offshore waters and deeper wells on land becoming more prevalent.

(b) National and Regional Forecasts

Table V-I presents forecasts of crude petroleum supplies and demands. Domestic production is expected to bottom out in 1982 at 7.70 mmbd, and then rise to 9.75 mmbd in 2003. Imports decline to 5.94 mmbd in 1979 from 6.55 mmbd in 1977, and rise to 8.19 mmbd in 2003. Total consumption falls to 14.27 mmbd in 1982 from 14.79 in 1977 and rises to 17.94 mmbd in 2003. Exports of crude petroleum are negligible and decline at approximately 3% per year. Regional shifts in domestic production share change over time, as energy policy shifts to promote recovery of heavy crudes in California and expanded levels of drilling in the Williston Basin in Wyoming and other potentially important production areas in the Rocky Mountain States (Padd 4), along with increased activity in offshore waters in the Gulf Coast, and in the offshore Pacific and Atlantic waters. Differences exist across macroeconomic alternatives in the level of national and regional production, with national production levels being 20.7% higher in 2003 for 'BADENERGY' at 11.77 mmbd, and 1.1% higher in 2003 for 'LARGERGOVT' at 9.86 mmbd as increased real and nominal prices for crude petroleum spur increased domestic production, and reduce consumption, which falls to 16.91 mmbd, a 5.6% decline, and to 17.36 mmbd, a 3.1% decline for 'BADENERGY' and 'LARGERGOVT' macroeconomic alternatives, respectively from 'TRENDLONG' at 17.9 mmbd. Imports shift as the swing supply factor, with values for 2003 reduced to 5.17 mmbd and 7.15 mmbd from 8.19 mmbd in 'TRENDLONG'. Regional response in production levels varies in proportion to incremental costs of production, with heavy crudes, offshore waters, and the Rocky Mountain states having the largest increases in production levels. Texas inland production levels are limited by declining reserves.

(c) Key Industry Developments

The model assumptions include the estimates of the level of response in exploration activity and success rates for domestic drilling activity to rising prices of crude petroleum. Technological changes associated with crude petroleum production are not expected to be substantial. The largest forecast risk is the accuracy of the projected OPEC pricing trajectory, and the responses in conservation and production seen in the United States.

[illegible]

Table C.1

National and Regional Crude Petroleum
Supplies and Demands

Scenario: [illegible]
Millions of Barrels per Year
Source: Energy Model

	1977	1980	1985	1990	1995	2000	2003	% Compound Annual Growth 1977 to 1990	% Compound Annual Growth 1990 to 2003
Supplies of Crude Petroleum									
New England	0.0	0.0	0.0	0.0	0.0	0.0	0.0	NC	NC
Middle Atlantic	3.7	3.2	2.3	2.1	2.0	1.9	1.6	4.2	2.2
South Atlantic	52.2	45.9	40.0	48.5	52.5	57.7	62.1	0.6	1.9
East North Central	84.5	73.9	60.9	68.0	71.3	75.1	78.5	-1.7	1.1
West North Central	93.4	82.8	71.1	73.4	72.3	69.5	67.6	1.8	0.6
East South Central #1	6.6	6.3	10.3	20.4	25.2	31.9	33.3	9.0	4.8
West South Central #1	163.8	146.9	135.4	146.1	145.8	[illegible]	141.2	0.9	[illegible]
East South Central #2	53.9	47.5	39.2	39.6	39.3	38.1	37.7	2.3	0.4
West South Central #2	1,712.2	1,516.7	1,297.7	1,341.6	1,328.9	1,290.2	1,266.0	1.9	0.4
Mountain #1	87.4	78.7	75.3	84.9	86.3	86.8	87.4	-0.2	0.2
Mountain #2	254.6	232.8	281.3	449.3	529.1	678.7	726.0	4.5	3.8
Mountain #3	1.7	1.5	1.1	1.0	0.9	0.8	0.7	4.2	2.2
Pacific	369.4	333.3	321.3	363.8	394.9	435.2	468.6	0.1	2.0
Alaska	124.1	511.0	584.0	584.0	584.0	584.0	584.0	12.7	0.0
Total U.S.	3,007.6	3,080.6	2,920.0	3,223.0	3,332.4	3,452.9	3,558.[illegible]	0.5	0.8
Imports	2,390.8	2,219.2	2,452.8	2,522.1	2,693.7	2,8[illegible].9	2,[illegible].3	0.1	1.1
Demands for Crude Petroleum									
New England	1.6	1.5	1.7	1.9	2.0	2.0	2.1	1.5	0.6
Middle Atlantic	492.9	481.2	488.8	522.5	542.1	560.0	571.6	0.4	0.7
South Atlantic	85.5	83.8	85.6	91.8	95.3	98.2	100.0	0.6	0.7
East North Central	876.9	865.4	865.8	913.0	952.8	992.4	1,018.1	0.3	0.8
West North Central	303.4	300.0	300.5	316.8	329.7	341.2	348.0	0.3	0.7
East South Central #1	67.4	66.7	67.3	71.2	74.1	76.7	78.2	0.4	0.7
West South Central #1	198.3	195.1	193.7	204.7	212.7	219.5	223.5	0.2	0.7
East South Central #2	134.1	130.3	132.8	142.1	146.6	150.4	152.7	0.4	[illegible]
West South Central #2	2,166.0	2,141.3	2,205.3	2,399.9	2,566.0	2,762.4	2,935.9	0.8	1.5
Mountain #1	29.2	28.1	28.4	30.2	31.0	31.6	32.0	0.3	0.4
Mountain #2	193.3	189.4	192.6	205.9	213.5	219.[illegible]	223.8	[illegible]	0.6
Mountain #3	1.6	1.5	1.7	1.9	2.0	2.0	2.1	1.5	0.6
Pacific	848.2	815.5	807.6	813.4	858.3	870.4	890.0	[illegible]	0.4
Total U.S.	5,398.4	5,299.8	5,372.8	5,745.1	6,026.1	6,312.8	6,519.1	[illegible]	1.0

It appears that as crude prices rise, conservation and domestic production by alternative energy sources may reach higher levels than forecast, which along with increased domestic production of crude petroleum could reduce imports significantly and achieve reductions in total petroleum demands.

DISTFIBUTION SYSTEMS

The analysis of the crude petroleum distribution and logistics systems included consideration of current and future trends in refinery location, barge/pipeline/tanker comparative economics and relative costs, modal attributes and competitive advantages, shifts in supply and demand of crude petroleum at both national and regional levels, waterway, port facility and pipeline system expansions, impacts of Federal regulations affecting production and transportation of hazardous materials and environmental issues, and other relevant factors.

(a) Role of Waterborne Transportation

Most crude petroleum pipeline shipments are not suitable for diversion by waterborne transportation competition, while most waterborne crude petroleum shipments are not suitable for diversion by pipeline. This reflects the relative costs and comparative advantages of each mode. In general, if it is feasible to ship via pipeline, crude petroleum movements will be accomplished by pipeline. The feasibility of shipment via pipeline is a financial investment decision, reflecting the cost of capital, the scope and variability of demand, investment costs, and other factors. Due to the relatively mature nature of the petroleum distribution infrastructure, most situations appropriate for pipeline transportation of crude petroleum have already been analyzed and exploited. It is only when relatively large shifts in supply or demand arise (such as the development of the Alaskan North Slope oil fields, accompanied by growing crude petroleum shortages in the Midwest in the foreseeable future) that major new crude petroleum pipeline systems become appropriate. The Northern Tier Pipeline is the last major crude petroleum pipeline likely to be built without massive new finds of domestic petroleum. Thus, waterborne transportation serves a limited number of primary end-markets; direct

imports of foreign crude to the United States to be delivered at coastal port/refinery complexes and coastal port/pipeline terminals for transportation inland via pipeline, coastal shipments from Alaska to the West and Gulf Coasts from the terminus of the Alaskan pipeline at Valdez, Alaska, other coastal shipments along and within the Pacific, Atlantic, and Gulf Coasts primarily as local redistribution moves of imported or inland produced crude petroleum, collection from isolated producing wells in the Gulf Coast bayous and offshore regions, and as a peak load transportation mode as an alternative to pipeline for internal moves when pipeline capacity or transmission facilities are not available. In 1977 pipeline carried 72% of domestic crude petroleum tons, as opposed to 13% for water on a total of 636,774,800 tons, while pipeline carried 83% of domestic crude petroleum ton-miles, opposed to 16% for water for domestic movements, on a total of 392,500,000,000 ton-miles. A total of 403,602,331 tons of crude petroleum were imported by water in 1977.

(b) Factors Affecting Modal Choice

The most important factor affecting modal choice for crude petroleum is the presence or absence of a pipeline. Pipelines are costly fixed investments, with large initial investments offset by lower operating costs, which require large, steady demands and supplies to economically operate. High interest rates discourage new pipeline investments, and other capital intensive undertakings, such as port facility expansion. For large steady flows between a limited number of originating and terminating stations along a common corridor, pipeline transportation is less expensive than barge. Its cost advantage over ocean or coastal tankers is not as large, which accounts for the absence of long line haul coastal crude pipelines. Barge serves demands not economically met by pipeline transportation in the long run, and demands occurring from short run shortfalls in pipeline capacity.

(c) Distribution System Developments

The crude petroleum distribution system is relatively mature. The existing infrastructure of wells in producing

regions, gathering and trunk pipelines, barge collection/transportation equipment, storage tank farms, refineries, and the associated investment in these act to retard sudden shifts in industry logistics. Increased flows of crude petroleum from Alaska to the West Coast and to the Gulf Coast have occurred since 1977, when the Alaskan pipeline came onstream. Crude movements from the Gulf to the East Coast are declining due to substitution by direct imports and declining Texas and Louisiana production levels. Expected developments in crude petroleum transportation include a Pacific Coast to Upper Midwest crude pipeline. Of four competing designs, the Federal Government has approved the Northern Tier pipeline consortium to attempt to secure financing. The Louisiana Off-shore Oil Port (LOOP) is about 50% complete and is expected to be on-line in early 1981. The Texas Superport is currently attempting to secure financial backing. Risks associated with the above three projects include the effects on bond markets of inflation and high interest rates.

WATERBORNE DEMAND PROJECTIONS

The Crude Petroleum Flow Model forecasts demand for waterborne flows of crude petroleum under macroeconomic alternatives, using as inputs current waterborne and pipeline flow patterns, forecasts of productions, imports, exports, supplies and consumption of crude petroleum from the Energy Model, and shifts in industry logistics and distribution systems from the analysis of industry distribution and logistics systems, including pipeline and port facility construction and expansion activity, shifts in relative modal costs, impacts of government regulations affecting production and transportation of hazardous materials and environmental issues and other relevant factors.

(a) Projection Summary

By 2003, total crude petroleum flows are 51% higher than in 1977, spurred by 119% increases in domestic traffic and 38% increases in import traffic. The bulk of the domestic flow increase results from increased flows from Alaskan North Slope oil production, rising from .34 mmbd in 1977 to 1.6 mmbd for 1985 to 2003, a 370% increase, while the import increase results from a growing shortfall between domestic production and consumption.

(b) Major Market Shifts

The 38% increase in waterborne crude oil imports results from: (1) a 25% increase forecast by the Energy Model of both pipeline and waterborne imports, (2) shifts in density of imported oils as substitution toward heavier crudes as the existing liftings of sweet, light crude decline, (3) a conceptual difference between the NWS definition of imports which considers landings at the domestic Caribbean to be imports, while the Energy Model accepts the DOE definition of imports as excluding landings at the domestic Caribbean as imports and (4) a difference in definitions for the landings of crude petroleum to Portland, Maine for transportation to Montreal, Canada which the ACOE defines as imports and which the DOE ignores. In order to maintain consistency with historical Corps information, all these adjustments had to be made to the forecast, resulting in a seemingly higher growth rate. However, most of the differential over the 25% crude oil import growth forecast is due to these adjustments in data, not to other, new demands for oil.

The domestic increase reflects the large increase in Alaskan North Slope production, and continued slow growth in coastal flows for collection/transportation and redistribution of imported and inland produced crudes. Internal traffic on the Mississippi River and tributaries and the Great Lakes also grows in proportion to total demand, but remains small flows due to its low values in 1977. Competitiveness of water with pipeline flows remains in favor of pipe for large concentrated flows. The Northern Tier Pipeline shifts flows from Alaska to the Gulf, and imports to the Gulf, for further transportation via pipeline to the Midwest to flows of Alaskan and imported crudes to the Pacific Northwest (Puget Sound) for further delivery to the Midwest via pipeline.

(c) Waterborne Flow Developments

Tables V-2, V-3, V-4, and V-5 present, respectively, domestic traffic (tons) shipped and received by NWS Reporting Segment, domestic traffic (tons) by NWS Reporting Segment for movements traversing all or part of an internal NWS Reporting Segment, domestic traffic (ton-miles) by internal NWS Reporting Segment for movements traversing

Table V-2

WATERBORNE DEMAND PROJECTIONS ([illegible] TONS)
DOMESTIC TRAFFIC

COMMODITY: Crude Petroleum
ALTERNATIVE: [illegible]

SEGMENT	IN/OUT	1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
Upper Mississippi	Shipped	1	1	1	1	2	2	2	0.9	1.7
	Received	597	[illegible] 182	[illegible]	[illegible]	66[illegible]	635	[illegible]13	0.4	0.3
Lower Upper Mississippi	Shipped	14	[illegible]	[illegible]	[illegible]	17	18	19	0.8	1.6
	Received	[illegible]	0	[illegible]	[illegible]		0	0	0.0	0.0
Lower Mississippi	Shipped	36	36	[illegible]	[illegible]	41	43	45	0.6	1.0
	Received	2,750	2,714	2,792	2,947	[illegible]	3,2[illegible]	3,309	0.5	0.9
Baton Rouge to Gulf	Shipped	11,066	11,427	11,352	12,232	13,119	14,098	14,761	0.8	1.5
	Received	12,168	19,923	15,520	15,268	14,830	16,905	18,845	1.8	1.6
Illinois River	Shipped	95	94	96	[illegible]	[illegible]	113	116	0.5	1.1
	Received	65	65	65	69	7[illegible]	[illegible]	79	0.4	1.1
Missouri River	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Shipped	38	74	38	40	42	44	45	0.4	0.9
	Received	357	354	361	381	402	421	432	0.5	1.0
Tennessee River	Shipped	3	6	3	3	4	4	4	0.4	0.9
	Received	9	9	9	9	[illegible]	10	10	[illegible]	0.9
Arkansas River	Shipped	4	4	4	4	5	5	5	0.6	0.8
	Received	21	20	21	22	23	24	2[illegible]	0.6	0.9
Gulf Coast West	Shipped	22,737	21,626	21,642	23,416	25,164	27,110	28,443	0.2	1.5
	Received	20,527	31,14[illegible]	25,329	25,226	24,770	27,722	30,429	1.6	1.5
Gulf Coast East	Shipped	1,028	884	781	848	917	997	1,053	1.5	1.7
	Received	347	202	60	65	70	[illegible]	81	12.1	1.7
Warrior River System	Shipped	3,807	3,807	3,871	4,189	4,51[illegible]	4,890	5,148	0.7	1.6
	Received	768	760	794	862	933	1,015	1,[illegible]71	0.9	1.7
South Atlantic Coast	Shipped	666	659	682	728	774	825	860	[illegible]	1.1
	Received	0	0	0	0	0	0	0	0.0	0.0
Middle Atlantic Coast	Shipped	13,967	13,703	14,183	15,[illegible]	15,[illegible]	16,609	17,[illegible]2	0.6	0.9
	Received	15,937	13,730	14,325	15,314	16,082	16,763	17,157	0.4	0.9

Table V-2 (continued)

SEGMENT	IN OUT	1977	1980	1985	YEAR 1990	1995	2000	2005	GROWTH 77-90	GROWTH 90-05
North Atlantic Coast	Shipped	0	0	0	0	0	0	0	[illegible]	0.0
	Received	0	0	0	0	0	0	0	[illegible]	[illegible]
Great Lakes and Seaway	Shipped	0	0	0	0	0	0	[illegible]	0.0	0.0
	Received	0	0	0	0	0	0	[illegible]	0.0	0.0
Washington/Oregon Coast	Shipped	526	519	524	550	577	602	616	0.4	0.9
	Received	4,767	16,877	38,424	42,647	47,068	46,619	46,057	18.4	0.6
Columbia Snake Willamette River	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	251	1,542	1,594	1,578	1,570	1,541	1,4[illegible]	15.1	0.4
California Coast	Shipped	12,618	12,141	12,2[illegible]	12,723	13,125	13,557	13,832	0.1	0.6
	Received	22,209	57,687	59,555	59,07[illegible]	58,868	5[illegible],919	56,403	7.8	0.4
Alaska	Shipped	14,897	84,097	95,994	96,063	96,1[illegible]	96,183	96,254	15.4	0.0
	Received	645	912	916	955	983	1,015	1,015	3.1	0.6
Hawaii and Pacific Territories	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	17	1,000	1,000	1,000	1,000	1,000	1,000	32.[illegible]	0.0
Domestic Caribbean	Shipped	54	54	54	54	54	54	54	0.0	0.0
	Received	122	122	122	122	122	122	122	0.0	0.0
Total	Shipped	81,557	149,148	161,47[illegible]	166,174	170,504	175,153	178,[illegible]65	5.[illegible]	0.5
	Received	81,557	149,148	161,477	166,174	170,504	175,153	178,26[illegible]	5.[illegible]	0.5

a = less than 500 tons

Table V-3

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL, AND THROUGH

COMMODITY: Crude Petroleum
ALTERNATIVE: Trendlong2003A

SEGMENT	1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
Upper Mississippi	598	1,183	602	631	667	697	714	0.4	0.9
Lower Upper Mississippi	752	1,335	757	797	840	881	904	0.4	1.0
Lower Mississippi	3,688	4,194	3,729	3,945	4,148	4,332	4,438	0.5	0.9
Baton Rouge to Gulf	18,415	26,544	21,880	22,065	22,652	24,565	25,786	1.4	1.5
Illinois River	150	149	151	159	168	177	183	0.4	1.1
Missouri River	0	0	0	0	0	0	0	0.0	0.0
Ohio River	406	443	411	434	457	478	491	0.5	1.0
Tennessee River	12	15	12	13	13	14	14	0.5	0.9
Arkansas River	21	20	21	22	23	24	25	0.6	0.8
Gulf Coast West	26,705	36,420	29,932	30,229	30,177	33,603	36,642	1.0	1.5
Gulf Coast East	4,857	4,731	4,714	5,104	5,507	5,966	6,285	0.4	1.6
Warrior River System	4,505	4,498	4,592	4,972	5,365	5,813	6,123	0.8	1.6
Great Lakes	0	0	0	0	0	0	0	0.0	0.0

a = less than 500 tons

Table V-4

WATERBORNE DEMAND PROJECTIONS
[illegible]
MISSISSIPPI RIVER [illegible] GREAT LAKES
[illegible]

COMMODITY [illegible]
ALTERNATIVE [illegible]

SEGMENT	[illegible]	[illegible]	[illegible]	YEAR 1990	[illegible]	2000	[illegible]	% GROWTH [illegible]	[illegible]
Upper Mississippi	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	126	136	0.4	[illegible]
Lower Upper Mississippi	[illegible]	[illegible]	[illegible]	[illegible]	183	[illegible]	[illegible]	0.4	[illegible]
Lower Mississippi	1,[illegible]	2,155	1,80[illegible]	1,9[illegible]2	2,012	2,1[illegible]4	2,[illegible]	[illegible]	[illegible]
Baton Rouge [illegible] Gulf	[illegible]	2,548	1,832	1,8[illegible]	1,[illegible]	1,9[illegible]	2,[illegible]	[illegible]	1.4
Illinois River	45	[illegible]	45	4[illegible]	[illegible]	[illegible]	[illegible]	0.4	[illegible]
Missouri River	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Ohio River	15[illegible]	159	152	1[illegible]	16[illegible]	178	182	[illegible]	[illegible]
Tennessee River	5	[illegible]	5	[illegible]	[illegible]	[illegible]	[illegible]	0.6	[illegible]
Arkansas River	[illegible]	[illegible]	[illegible]	3	4	4	4	0.6	*
Gulf Coast West	2,[illegible]	2,999	2,921	3,0[illegible]	3,262	3,[illegible]	3,7[illegible]9	0.9	[illegible]
Gulf Coast East	5[illegible]	504	4[illegible]	523	564	610	642	[illegible]	1.6
Warrior River System	2[illegible]	231	2[illegible]	2[illegible]	276	2[illegible]	[illegible]	[illegible]	1.6
Great Lakes	0	[illegible]	0	0	[illegible]	0	[illegible]	[illegible]	[illegible]
Total	7,495	9,[illegible]	8,080	8,3[illegible]	8,[illegible]69	9,[illegible]	9,9[illegible]	0.9	1.3

* = less than 500,000 ton miles

Table V-5

WATERBORNE DEMAND PROJECTIONS [illegible]

[illegible]

[illegible]

[illegible]	EXP/IMP	1977	[illegible]	[illegible]	YEARS [illegible]	[illegible]	[illegible]	2003	% GROWTH [illegible]	[illegible]
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	78,668	89,45[illegible]	101,46[illegible]	[illegible]	111,87[illegible]	120,96[illegible]	[illegible]	2.1	1.5
Illinois River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	53	[illegible]	42	[illegible]	[illegible]	26	25	3.0	2.8
	Imports	118,939	135,24[illegible]	153,4[illegible]	155,87[illegible]	169,152	182,881	[illegible],454	[illegible]	[illegible]
Gulf Coast East	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	9,270	10,420	11,904	12,044	13,02[illegible]	14,[illegible]	14,5[illegible]	2.0	1.5
Warrior River System	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	42	48	55	[illegible]	[illegible]	[illegible]	68	[illegible]	[illegible]
South Atlantic Coast	Exports	8	8	8	8	8	8	8	[illegible]	2.9
	Imports	[illegible]	849	1,081	[illegible]	[illegible]	[illegible]	[illegible]	1.8	0.4
Middle Atlantic Coast	Exports	200	181	15[illegible]	[illegible]	[illegible]	[illegible]	94	[illegible]	2.8
	Imports	80,4[illegible]	81,0[illegible]	94,[illegible]	89,8[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.8

Table V-5 (continued)

Region	Exp/Imp	1977	[illegible]	1985	YEARS [illegible]	[illegible]	[illegible]	[illegible]	Growth [illegible]	[illegible]
North Atlantic Coast	Exports	0	0	0	0	0	[illegible]	0	[illegible]	[illegible]
	Imports	12,910	9,425	15,[illegible]2	20,[illegible]	22,[illegible]	24,[illegible]	[illegible]	[illegible]	2.[illegible]
Great Lakes and Seaway	Exports	0	0	0	0	0		0	[illegible]	[illegible]
	Imports	38	32	38	40	42	[illegible]	45	0.4	1.1
Washington-Oregon Coast	Exports	0	0	0	0	0	0	0	[illegible]	0.0
	Imports	10,801	2,801	22,921	27,232	31,543	31,543	[illegible]	[illegible]4	1.1
Columbia Snake Willamette River	Exports	0	0	0	0	0	0	0	[illegible]	[illegible]
	Imports	317	82	82	82	82	82	82	[illegible]	[illegible]
California Coast	Exports	0	0	0	0	0	0	0	0.0	[illegible]
	Imports	45,790	12,141	12,141	12,141	12,141	12,141	12,141	9.9	0.0
Alaska	Exports	1,711	0	0	0	0	0	0	100.0	0.0
	Imports	303	0	0	0	0	0	0	100.0	0.0
Hawaii and Pacific Territories	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	2,480	1,388	1,398	1,494	1,574	1,656	1,703	3.8	1.0
Domestic Caribbean	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	42,834	43,387	46,[illegible]	50,908	52,704	54,022	54,[illegible]	[illegible]	.6
Total	Exports	1,964	232	199	171	147	126	118	17.1	2.8
	Imports	405,751	385,766	450,864	474,126	509,758	540,[illegible]	560,[illegible]	1.2	1.3

a = less than 500 tons

all or part of an internal NWS Reporting Segment, and foreign trade traffic (tons) exported and imported by NWS Reporting Segment.

Both imports and domestic movements are prominent in crude petroleum waterborne movements during the forecast period. Domestic movements of crude petroleum predominantly originate or terminate at relatively few locations; Baton Rouge-Gulf, Gulf Coast West, Middle Atlantic Coast, Washington-Oregon Coast, California Coast, and Alaska. Internal shipments of crude petroleum on the mainstem Mississippi, Missouri, Ohio, Tennessee, and Arkansas are primarily terminations, with growth rates for both originations and terminations for 1977-1990 ranging from .4% per year to .9% per year, and for 1990-2003 ranging from .8% per year to 1.7% per year. Baton Rouge, Warrior River system and Gulf Coast West ship and receive substantial amounts of domestic crude petroleum from local inland, local bayou, and offshore area production, and also exhibit some redistribution flows of imported and inland produced crude petroleum. Growth rates range from .2% per year to .8% per year for 1977-1990 and 1.5% per year for 1990-2003 for originations from these three segments, while terminations range from 1.6% per year to 1.8% per year for 1977-1990 and 1.5% per year to 1.6% per year from 1990-2003 for these three segments. The Gulf Coast East ships moderate amounts of crude which bottom out in 1985 and then rise thereafter to 2003. Terminations decline due to substitution by imports. The South Atlantic, North Atlantic, and Great Lakes receive no domestic crude, while the latter two segments also originate no domestic crude shipments. South Atlantic originations trend upwards at .7% for 1977-1990, and 1.3% for 1990-2003. The Middle Atlantic receives some domestic crude by water from the Gulf, but this flow is expected to reflect redistribution flows of imported crude petroleum, and trend upwards at between .6% to .9% per year for originations, while terminations decrease to 1985 and then rise, reflecting the declining Gulf Coast shipments, with growth rates of -.3% per year for 1977-1990 and .9% per year for 1990-2003. Domestic crude petroleum shipments and receipts on the West Coast are predominantly Alaskan crude petroleum movements although some offshore production collection/transportation and local inland and import redistribution flows are also present. These latter movements are more prevalent along the California Coast than along the Oregon-Washington Coast. Alaskan originations and West Coast and

Columbia-Snake Waterway terminations of crude petroleum flows rise at between 7.8% per year and 18.4% per year for 1977-1990, the higher figure for the Washington-Oregon Coast reflecting increased shipments of Alaskan crude to the Northern Tier Pipeline, and the lower figure for the California Coastline reflecting previously existing domestic waterborne movements of crude petroleum which fail to rise at as rapid a pace as the Alaskan receptions, with low mixed growth rates for 1990-2003, reflecting Alaskan production having reached full levels of 1.6 mmbd in 1985. Alaskan terminations and West Coast and Columbia-Snake Waterway originations of crude petroleum generally exhibit low growth rates of less than 1% per year for 1977-1990 and for 1990-2003, with Alaskan terminations rising at 3.1% per year for 1977-1990 due to displacement of imported crude petroleum. Partial substitution of Alaskan crude for imports to Hawaii accounts for the high growth rate for receipts of domestic movements to Hawaii for the 1977-1990 period, while domestic movements to/from the domestic Caribbean are expected to hold steady.

Tonnage and ton-mile changes for domestic movements of crude petroleum traversing internal NWS Reporting Segments generally reflect the previously discussed originated and terminated tonnage changes, with domestic traversing tonnage changes and ton-mile changes generally similar to one another, and generally between the growth rates of the segments' originated and terminated traffic tonnages changes. Exceptions to this include the Gulf Coast East, where traffic moving through the segment maintains tonnage and ton-miles in the face of declining originations and terminations for domestic traffic.

Foreign trade in crude petroleum is predominantly imports, with the United States being a substantial net importer of crude petroleum. Exports of crude petroleum are small, and are predominantly located along the Gulf Coast and the Middle Atlantic Coast. These flows are expected to decline at approximately 3% per year during the forecast period. The Alaskan exports exhibited in 1977 are not expected to continue. The primary receivers of imported crude petroleum are the Baton-Rouge-Gulf and Gulf Coast West segments, which grow at 2.1% per year for 1977-1990 and 1.6% per year for 1990-2003. This reflects the substantial share of refinery capacity located through the Gulf Coast region or accessible via crude petroleum

pipeline from the Gulf Coast. Smaller flows are received by the Gulf Coast East, reflecting the small number of refineries located in this region, with growth rates for 1977-1990 of .9% per year and 1.5% per year for 1990-2003. Substantial flows are received at the Middle Atlantic Coast with growth rates of .9% for 1977-1990 and .8% for 1990-2003, reflecting low petroleum product demand growth for the Middle and North Atlantic states. The domestic Caribbean increases steadily with growth rates at 1.3% per year for 1977-1990 and .6% per year for 1990-2003. The North Atlantic coast receipts of imported crude petroleum are destined for refineries in Montreal, Canada and are not related to changes in the United States economy. They reflect increasing growth in eastern Canadian petroleum product demand, shortfalls in supply of western Canadian crude via transcontinental pipeline, and prospects of commercially recoverable crude petroleum discoveries in the Canadian Atlantic offshore waters. The Washington-Oregon Coast receipts of imported crude petroleum exhibits decline to 1980, with growth to 1995, and constant thereafter, with growth rates of 7.4% per year for 1977-1990 and 1.1% per year for 1990-2003. These changes reflect demands for crude for the Northern Tier Pipeline, and some imports of sweet, low sulphur crude to the Puget Sound refineries. The California Coast declines from 1977 to 1980, reflecting the same displacement of imports by Alaskan crude exhibited by the Oregon-Washington Coast, followed by steady demand for sweet, low sulphur crudes. Imports to Alaska are expected to be displaced by increased Alaskan production, while partial displacement of imports by Alaskan crude accounts for the negative growth rates for imports to Hawaii. Small flows to the South Atlantic are expected to exhibit a downward trend, with growth rates of -1.8% per year for 1977-1900 and -.4% per year for 1990-2003. Smaller flows to the Warrior River system are expected to exhibit growth rates similar to other importing segments like the Gulf Coast West and Baton Rouge-Gulf segments of 2.1% growth per year for 1977-1990 and 1.6% growth per year for 1990-2003.

Major flow patterns in crude petroleum are expected to exhibit some shifts in the forecast period. Domestic flows from the Gulf Coast to the Middle Atlantic Coast are expected to be displaced by imports by 1985. The LOOP (and potentially the Texas Superport) will enable the Gulf Coast to receive supertanker sized loads of crude petroleum and act to increase refinery capacity concentration

through the Gulf Coast as transportation costs to the Gulf Coast are reduced. Increased Alaskan crude production displaces imports to Alaska, and partially displaces imports to Hawaii. Alaskan to Gulf Coast crude flows increase substantially over 1977 levels as Alaskan production rises to its full production level in 1985, while Alaskan to West Coast flows substantially displace imports for West Coast refinery operations except for continued imports of sweet, low sulphur crudes which remain at reduced levels. The construction of the Northern Tier pipeline attracts large flows of both Alaskan and imported crude petroleum by 1985, rising to 1995 when full flows through the pipeline are achieved.

VI - NON METALLIC MINERALS

INDUSTRY OUTLOOK

The reporting commodity Non-Metallic Minerals includes five analysis commodities: A9 - sand, gravel, and crushed rock; A10 - limestone flux, calcareous stone, and gypsum; A11 - phosphate rock and other natural fertilizers; A12 - dry and liquid sulfur; A13 - other non-metallic minerals. Although combined into a single reporting commodity for NWS, most non-metallic minerals are not directly related in terms of production or demand. For this reason, outputs from several industry models, two Bureau of Mines forecasts, and variables forecast by the macro-model of the United States economy, were all used to produce the waterbone traffic demand projections.

(a) Industry Background

Because a number of different industries produce and use non-metallic minerals, the growth rates for various non-metallic minerals differ widely. The first analysis commodity, A9, includes sand, gravel, and crushed rock. The Bureau of Mines reports that domestic production and demand for sand and gravel both fell around .5% per year from 1969 to 1977, while production and demand for crushed rock rose about .8% per year. In 1977, 895 million tons of sand and 914 million tons of crushed rock were produced; 97% of the sand and gravel and 90% of the crushed rock was used by the construction industry.

Three products with different uses make up A10: limestone flux is used in iron and steel production; calcareous stone is used primarily to make lime and cement; and gypsum is used primarily for sheet rock and other prefabricated building materials. Domestic production of limestone flux declined sharply from a record 40.9 million tons in 1953 to 22.5 million tons in 1976, as the amount of flux used per ton of steel produced declined. No specific industry background can be given for calcareous stone because three-quarters of all crushed rock is crushed limestone and it is not clear what distinguishes calcareous stone from crushed limestone. Production from domestic gypsum mines rose 3.9% per year

between 1969 and 1977 to 13.4 million tons, and by-product gypsum primarily from fertilizer manufacturing contributed another .8 million tons. Total domestic demand for gypsum rose 3.3% per year between 1969 and 1977 to 20.5 million tons.

Phosphate rock is the major commodity in All. Total domestic production rose an average 4.1% per year from 1969 to 1977, reaching 52.1 million tons in 1977. Florida, North Carolina, Tennessee, Idaho and Utah produce phosphate rock, with Florida accounting for approximately 80%. In 1977, 63.5% of domestic production was used to make phosphate fertilizer for domestic and foreign consumption, 27.9% was exported and 8.6% was used to produce industrial chemicals. Increasing domestic and foreign demand for fertilizer caused the growth in phosphate rock production. From 1970 to 1977, domestic phosphate fertilizer application measured in tons of P205 rose 3.0% per year, phosphate rock exports grew 4.3% per year, and combined exports of superphosphates, ammonium phosphates, and phosphoric acid grew 15.1% per year. The detergent industry is the major non-agricultural use of phosphates; its demand is expected to remain relatively constant as rising demand for low phosphate detergents (in response to water pollution problems) offsets increases in detergent production

(b) National and Regional Forecasts

Table VI-I presents the baseline industry forecasts and macro-economic variables used in making waterborne traffic demand projections. The sand, gravel, and crushed stone forecasts were produced by a model relating demand to construction activity, and the phosphate fertilizer forecast was produced by a model of the agriculture industry. Forecasts of phosphate rock production and sulfur demand were made by the United States Bureau of Mines.

Industry forecasts of sulfur and phosphate rock warrant special attention. Restrictions on sulfur emissions are expected to increase the amount of recovered sulfur produced, slowing increases in sulfur prices and

encouraging new uses like sulfur-asphalt paving and sulfur concrete. New uses plus growth in fertilizer production account for the strong growth in sulfur demand. The demand for phosphate fertilizer will grow despite the forecast decline in phosphate rock production; as a result, phosphate rock exports will decrease after 1985.

(c) Key Industry Developments

The major non-metallic mineral industry developments are largely a result of environmental regulations. Air pollution standards limiting sulfur emissions coupled with a limited supply of natural sulfur deposits will lead to increased production of recovered sulfur; the recovered sulfur share of domestic production is expected to increase from approximately 50% to 75%. Phosphate rock production in Central Florida is projected to decrease after 1985 largely because pollution and land-use regulations restrict the ability to open new mines or expand existing ones. Finally, restrictions on dredging will continue to reduce the amount of sand and gravel obtained from rivers and lakes.

DISTRIBUTION SYSTEM

The distribution systems of non-metallic minerals vary by commodity. Some nonmetallic minerals are produced and consumed in a large number of locations with flows subject to vigorous modal competition; other minerals are mined, shipped, and used by large integrated corporations, and for these flows modal competition is much less an issue. Because of these differences this section will consider the role of water transportation, factors affecting modal choice, and distribution system developments for each major non-metallic mineral separately.

(a) Role of Water Transportation

Trucks carry most sand, gravel and crushed rock. In 1977 internal barge traffic totalled 48.8 million tons, a substantial amount but only 2.7% of domestic production, while Class I railroad traffic totalled 77.0 million tons. The barge share decreased from 1969 to 1977;

Table VI-1

Industry Forecasts for Non Metallic Minerals - Scenario elrenstong2003A
(Million Tons)

	1977	1980	1985	1990	1995	2000	2003	% Compound Annual Growth 1977 to 1990	1990 to 2003
U.S. Demand for Sand, Gravel, and Crushed Stone									
Sand and Gravel	898	928	994	983	969	986	1,009	0.7	0.2
Crushed Stone	914	1,001	1,231	1,258	1,263	1,334	1,402	2.5	0.8
Total	1,812	1,929	2,225	2,242	2,232	2,320	2,411	1.7	0.6
U.S. Demand for Phosphate Fertilizer - Million Tons of P205									
Total	5.6	5.6	6.4	6.9	7.6	9.0	8.3	1.6	1.4
U.S. Production of Phosphate Rock									
Central Florida	38.6	43.1	50.7	46.7	42.6	38.6	36.2	1.5	-1.9 (A)
Total	52.1	64.1	72.4	68.7	65.0	61.3	59.1	2.2	-1.2 (A)
U.S. Demand for Sulfur									
Total	12.9	15.0	21.0	24.5	28.0	31.5	33.6	5.1	2.5 (A)
Macro economic Model Variables - in Billions of Dollars									
Exports of Industrial Supplies and Materials (1967 Dollars)	15.9	17.8	21.9	25.4	29.6	34.6	38.0	3.7	3.1
Gross Investment in Total Structures (1972 Dollars)	96.5	102.0	124.8	127.5	128.0	135.0	141.8	2.2	0.8
Gross Investment in Private Nonresidential Structures (1972 Dollars)	40.0	46.5	53.6	61.7	67.8	74.4	78.1	3.4	1.8
Industrial Production Index - Total	1.37	1.52	1.94	2.32	2.72	3.21	3.56	4.1	3.4

(A) - Linear Extrapolation of Bureau of Mines 1977-2000 Forecast

although production grew slightly internal barge traffic fell 3.5% per year. Most sand, gravel and crushed rock is used in construction; most traffic is short-haul because supplies are widely available and transportation costs make up a large percentage of total costs. Sand, gravel, and crushed rock move on most waterway segments; flows in 1977 were heaviest on the Ohio River, the Atlantic Coast from Chesapeake Bay to New York and the Columbia/Snake. Most of the relatively small foreign trade is with Canada; in 1977, 2.8 million tons or roughly two-thirds of total imports were waterborne, but only 1.5 million tons or about one-fifth of total exports were waterborne.

Waterborne traffic in limestone flux, calcareous stone, and gypsum originates primarily in Michigan quarries along Lake Huron and moves via the Great Lakes to steel, cement, and wallboard plants. Often one corporation controls mining, shipping, and manufacturing. Lakewise traffic in limestone flux and calcareous stone decreased 1.8% per year between 1969 and 1977 to 26.9 million tons, while lakewise gypsum flows increased 4.3% per year to 1.1 million tons or 7.8% of 1977 domestic production.

About 80% of phosphate rock is mined in Florida; the largest waterborne flows are exports from Florida and coastwise shipments to Gulf Coast fertilizer plants, mainly in the Baton Rouge-New Orleans region. In 1977, Florida produced around 42 million tons of phosphate rock. About 33 million tons were loaded on rail cars, mostly for trips to nearby fertilizer plants or to ship and barge loading terminals. Ships loaded 13.5 million tons for export, and ships and barges moved 8.3 million tons to Gulf Coast destinations, including 6.9 million tons to the Baton Rouge-New Orleans area. Gulf Coast fertilizer plants used most phosphate rock, although .8 million tons were loaded onto river barges for shipment to inland fertilizer and chemical plants. Between 1969 and 1977 flows from Florida to Lower Mississippi ports increased 10.8% per year and exports rose 4.3% per year, but between 1973 and 1977 barge shipments from Lower Mississippi ports to docks on the Illinois and Upper Mississippi Rivers fell 10.8% per year.

Sulfur is shipped in two forms, molten and dry. Most domestic waterborne shipments are molten, but all foreign trade shipments are dry to avoid the cost of keeping the sulfur heated on long trips. Domestic waterborne traffic consists mainly of internal flows along the Gulf-Intracoastal Waterway and coastwise shipment from Texas and Louisiana to the Tampa region where phosphate fertilizer plants consume large quantities of sulfur. In 1977, internal and coastwise flows of molten sulfur totalled 8.3 million tons, equal to 77.6% of domestic production. From 1969 to 1976 coastwise molten sulfur shipments grew 4.2% per year while internal shipments fell 1.6% per year. During the same period, exports of dry sulfur fell 3.4% per year and imports grew 1.9% per year as increasing domestic demand changed the United States from a net exporter to a net importer of sulfur.

Domestic waterborne salt traffic originates mainly in Louisiana west of the Mississippi River, with smaller amounts originating on Lake Erie, Lake Michigan and San Francisco Bay. In 1977, the waterborne tonnage originated in these four areas totalled 5.8 million tons or 13.5% of domestic production, and waterborne imports accounted for another 3.1 million tons. Most of this sale is rock salt used to produce chemicals to melt ice on roads. Major inland destinations for barge traffic include the Illinois River (1.1 million tons in 1977) and the Upper Mississippi and Middle Ohio Rivers (.5 million tons each).

(b) Factors Affecting Modal Choice

Price is the major factor affecting modal choice for non-metallic minerals because most are low-value bulk commodites, making inventory costs a relatively low percentage and transportation costs a high percentage of total costs. Sand, gravel and crushed rock is an exception; trucks dominate this traffic because service is often important, most movements are short-haul, and because shipments patterns change frequently as construction projects begin and end. Railroads carry over half the sand and gravel used in metal casting, glass-making, and other industrial processes because this traffic is longer-haul and shipment patterns more fixed. Barges carry sand and gravel primarily when these commodities are produced by dredging.

Truck traffic in limestone used for cement and steel production is generally limited within quarries and feeder service for rail and water, although trucks serve nearby cement and steel plants directly. Where possible, quarries and plants are located to take advantage of low cost waterborne transportation, as witnessed by the large number of quarries and cement plants along the Great Lakes.

Modal choice for phosphate rock shipments involves production decisions. The two major alternatives are: 1) shipping phosphate rock by water from Florida to Louisiana fertilizer plants and fertilizer by barge from Louisiania to the Corn Belt, or 2) manufacturing fertilizer in Florida and shipping it by rail to the Corn Belt. Production of phosphate and fertilizer, as well as the distribution of fertilizer are often controlled by single corporations, and the modal choice is generally made as part of an overall production/distribution strategy.

For other major non-metallic minerals, production location is a key factor. Waterborne transportation is generally used for long hauls when available, with railroads providing long-haul competition and trucks serving mainly a distribution role.

(c) Distribution System Developments

Changes are expected in the distribution systems of sand and gravel, sulfur and phosphate rock. Environmental restrictions on dredging, the use of pipelines to bring sand and gravel ashore and increasing competition from truck-served land quarries will cause a decline in internal barge shipments despite increasing truck costs, although a shortage of supplies in the eastern Great Lakes region should produce steady growth in lakewise traffic.

The sulfur distribution system will change more dramatically. Rising demand for sulfur, limited Frasch sulfur production capacity, and environmental restrictions on sulfur emissions will combine to give recovered sulfur an increasing market share. Because production of recovered sulfur is decentralized and recovered sulfur has

traditionally been shipped by rail, the rail share of sulfur transportation will increase; from 1969 to 1977, Class 1 rail shipments increased 4.7% per year while internal waterborne shipments decreased 1.6% per year.

Phosphate rock shipments to inland fertilizer plants will continue their steep decline and disappear in the 1990s as rising transportation costs force fertilizer firms to locate production facilities near the sources of raw materials.

WATERBORNE DEMAND PROJECTIONS

The non-metallic mineral traffic models were based primarily on national production and demand forecasts so, in most cases, waterborne traffic demand was projected by traffic class and allocated to segments on the basis of past shares. Where stable historical relationships existed, macroeconomic variables were used to project waterborne traffic. Whenever regional production, demand or mode share information was available, this data was used to check and, if necessary, modify the demand projections.

(a) Summary

Non-metallic mineral traffic will decline on most segments between 1977 and 2003; Table VI-2 shows increases on only 5 of 22 domestic segments. The Ohio River and Middle Atlantic Coast lose the most tonnage, the result of decreasing sand and gravel shipments. Heaviest traffic and strongest growth is on the Great Lakes; shipments increase 36.7 million tons and receipts 37.2 million tons primarily because of growth in sand and gravel and limestone traffic.

(b) Major Market Shifts

Two major market shifts are expected. As a result of dredging restrictions, barges will continue to lose sand and gravel traffic to trucks. Even though the barge market share and the rate of decline in barge tonnage are

both small, this shift still amounts to a major loss in terms of tonnage.

The second shift involves sulfur. Railroads currently carry a large share of recovered sulfur, while barges carry most Frasch sulfur. As the share of production supplied by recovered sulfur increases, the rail share will increase as well. Waterborne sulfur traffic will grow, but at a slower rate than the increase in production or demand.

(c) Waterborne Flow Changes

In addition to the Great Lakes traffic mentioned previously, traffic on several other segments shows steady growth. Phosphate rock shipments from the Gulf Coast East to the Baton Rouge area and sulfur shipments from the Gulf Coast West to Baton Rouge and Florida grow to meet the rising demand for phosphate fertilizer. In foreign trade (Table VI-5), the most striking change is the 10.8 million ton decline in Gulf Coast East exports from 1985 to 2003. The increasing domestic demand for fertilizer plus decreasing phosphate rock production in Central Florida cause this drop. Because much non-metallic mineral traffic is short-haul, there is relatively little through traffic compared to shipments and receipts; for this reason, the trends in total domestic traffic (Table VI-3) closely resemble trends in domestic shipments and receipts. In most cases, the rates of change in ton-miles follow tonnage trends, but on the Ohio, a 33.0% drop in tonnage leads to a 9.7% in ton-miles, because most of the traffic is short-hauled sand and gravel shipments.

Table VI-2

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY: Nonmetallic Minerals
ALTERNATIVE: [illegible]

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	[illegible]	[illegible]	[illegible]	% GROWTH [illegible]	[illegible]
Upper Mississippi	Shipped	1,970	1,918	1,764	1,491	[illegible]	[illegible]	1,141	2.1	2.0
	Received	2,[illegible]	2,953	2,515	2,184	[illegible]	[illegible]	1,882	2.4	1.1
[illegible] Upper Mississippi	Shipped	1,136	1,104	1,016	864	78[illegible]	746	668	2.1	2.0
	Received	1,383	1,358	1,290	1,153	[illegible]	[illegible]	[illegible]	1.1	0.8
Lower Mississippi	Shipped	661	644	593	500	45[illegible]	432	383	2.1	2.0
	Received	1,876	1,834	1,726	1,52[illegible]	1,44[illegible]	1,41[illegible]	1,325	1.6	1.1
Baton Rouge to Gulf	Shipped	4,721	4,981	5,481	5,495	5,605	[illegible]	[illegible]	1.2	0.7
	Received	10,398	10,748	13,342	15,021	[illegible]	2[illegible]	[illegible]	2.9	2.1
Illinois River	Shipped	3,571	3,492	3,245	2,77[illegible]	2,5[illegible]2	2,335	2,2[illegible]	1.9	1.8
	Received	6,450	6,[illegible]	5,686	[illegible]	4,[illegible]	4,[illegible]	4,[illegible]	[illegible]	[illegible]
Missouri River	Shipped	3,049	2,970	2,734	2,3[illegible]6	2,101	[illegible]989	[illegible]	2.1	2.0
	Received	3,166	3,0[illegible]	2,864	2,45[illegible]	2,261	2,[illegible]	1,[illegible]	2.[illegible]	[illegible]
Ohio River	Shipped	19,451	18,924	17,435	14,758	13,473	12,726	11,344	2.1	2.[illegible]
	Received	19,352	18,83[illegible]	17,603	15,[illegible]	14,273	13,[illegible]64	12,630	1.8	1.5
Tennessee River	Shipped	2,551	2,485	2,287	1,930	1,761	[illegible]664	1,477	2.1	2.0
	Received	2,927	2,871	2,722	2,4[illegible]	2,[illegible]	2,[illegible]	2,186	1.4	0.8
Arkansas River	Shipped	2,989	2,911	2,680	2,261	2,062	1,919	1,730	2.1	2.0
	Received	3,017	2,939	2,707	2,288	2,[illegible]	1,976	1,[illegible]	2.1	2.[illegible]
Gulf Coast West	Shipped	12,268	12,654	13,490	13,[illegible]	14,[illegible]	15,[illegible]4	15,562	0.9	0.9
	Received	6,705	6,[illegible]	6,744	6,492	6,[illegible]	6,62[illegible]	6,5[illegible]	0.2	0.[illegible]
Gulf Coast East	Shipped	9,985	10,175	12,512	14,[illegible]4	16,302	[illegible]	18,515	2.2	2.1
	Received	5,202	5,688	6,644	[illegible]	6,[illegible]	[illegible]	[illegible]	2.1	1.5
Warrior River System	Shipped	2,465	2,382	2,193	1,936	1,[illegible]	1,651	1,5[illegible]	2.0	1.8
	Received	1,792	1,757	1,655	1,464	1,390	[illegible]	1,2[illegible]	1.5	1.1
South Atlantic Coast	Shipped	758	798	811	779	[illegible]	[illegible]	[illegible]	0.4	0.6
	Received	1,132	1,173	1,2[illegible]	1,280	1,32[illegible]	1,380	1,4[illegible]	0.9	0.8
Middle Atlantic Coast	Shipped	9,018	10,333	8,928	8,[illegible]	[illegible]	[illegible]	4,[illegible]	[illegible]	[illegible]
	Received	10,129	11,[illegible]	10,0[illegible]	9,149	[illegible]	[illegible]	[illegible]	[illegible]	1.8

Table VI-2 (continued)

SEGMENT	IN OUT	YEARS 1977	1980	1985	1990	[illegible]	[illegible]	[illegible]	% GROWTH [illegible]	[illegible]
North Atlantic Coast	Shipped	950	[illegible]	[illegible]	874	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Received	342	[illegible]	344	[illegible]	[illegible]	[illegible]	199	[illegible]	[illegible]
Great Lakes and Seaway	Shipped	31,236	37,329	44,236	51,854	[illegible]	[illegible]	67,893	4.0	[illegible]
	Received	29,710	35,887	42,920	[illegible]	[illegible]	[illegible]	66,[illegible]	[illegible]	2.2
Washington/Oregon Coast	Shipped	2,551	2,591	2,378	2,[illegible]	[illegible]	1,722	1,530	1.5	2.4
	Received	2,719	2,785	2,543	2,[illegible]	[illegible]	[illegible]	[illegible]	1.4	[illegible]
Columbia Snake Willamette River	Shipped	4,842	4,760	4,369	3,714	3,359	3,[illegible]	2,778	2.0	2.2
	Received	4,597	4,484	4,127	3,489	3,181	[illegible]	2,668	2.1	[illegible]
California Coast	Shipped	714	786	706	663	553	458	390	[illegible]	4.0
	Received	853	[illegible]	[illegible]	780	[illegible]	[illegible]	4[illegible]8	[illegible]	[illegible]
Alaska	Shipped	24	26	23	22	18	14	[illegible]	[illegible]	4.8
	Received	100	108	100	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2.4
Hawaii and Pacific Territories	Shipped	49	55	49	45	36	[illegible]	23	[illegible]	[illegible]
	Received	68	75	68	63	53	43	[illegible]	[illegible]	[illegible]
Domestic Caribbean	Shipped	2	*	*	*	*	*	*	[illegible]	[illegible]
	Received	45	46	44	42	40	[illegible]	[illegible]	[illegible]	[illegible]
Total	Shipped	114,959	122,179	127,853	130,571	134,273	142,578	[illegible]	[illegible]	[illegible]
	Received	114,959	122,179	127,853	130,571	134,273	142,578	[illegible]	[illegible]	[illegible]

* = less than 500 tons

Table VI-3

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL, AND THROUGH

COMMODITY: Nonmetallic Minerals
ALTERNATIVE: [illegible]

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	2,997	2,853	2,575	2,184	2,003	1,985	1,882	-2.4	-1.1
Lower Upper Mississippi	4,276	4,082	3,782	3,469	3,334	3,447	3,512	-1.6	0.1
Lower Mississippi	8,263	8,058	7,782	7,439	7,426	7,754	7,899	0.8	0.5
Baton Rouge to Gulf	17,576	18,004	20,970	22,770	25,369	30,382	28,684	2.0	1.8
Illinois River	6,635	6,388	5,495	5,246	4,879	4,723	4,507	-1.8	-1.2
Missouri River	3,218	3,140	2,910	2,490	2,298	2,199	1,985	-2.0	-1.7
Ohio River	22,146	21,631	20,209	17,649	16,529	16,004	14,760	-1.7	-1.4
Tennessee River	3,329	3,262	3,082	2,741	2,612	2,571	2,419	-1.5	-1.0
Arkansas River	3,018	2,940	2,708	2,289	2,090	1,977	1,758	-2.1	-2.0
Gulf Coast West	13,681	14,066	14,906	15,179	15,778	16,599	17,014	0.8	0.9
Gulf Coast East	14,058	14,685	17,957	19,753	22,137	26,713	24,716	2.7	1.7
Warrior River System	2,661	2,580	2,403	2,130	1,993	1,915	1,788	-1.7	-1.3
Great Lakes	31,287	37,380	44,287	51,906	57,811	64,238	67,949	4.0	2.1

a - less than 500 tons

Table VI-4

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY Nonmetallic Minerals
ALTERNATIVE Trendlong2003A

SEGMENT	1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
Upper Mississippi	400	368	321	274	254	271	280	2.9	0.2
Lower Upper Mississippi	693	656	605	564	546	575	602	1.6	0.5
Lower Mississippi	4,698	4,578	4,448	4,323	4,361	4,608	4,763	0.6	0.7
Baton Rouge to Gulf	2,141	2,163	2,532	2,768	3,117	3,810	3,549	2.0	1.9
Illinois River	605	579	536	488	458	448	440	-1.6	0.8
Missouri River	394	386	363	320	303	297	277	1.6	1.1
Ohio River	2,860	2,826	2,751	2,532	2,513	2,623	2,583	0.8	0.0
Tennessee River	294	290	280	259	255	259	252	0.9	0.2
Arkansas River	45	44	41	35	32	31	28	1.9	1.8
Gulf Coast West	1,319	1,366	1,471	1,498	1,553	1,627	1,664	1.0	0.8
Gulf Coast East	582	616	692	708	728	762	769	1.5	0.6
Warrior River System	221	214	199	173	160	153	141	1.9	1.6
Great Lakes	9,607	11,339	13,707	15,481	17,167	19,009	20,076	3.2	2.0
Total	23,859	25,426	27,545	29,485	31,507	34,493	35,424	1.6	1.4

a = less than 500,000 ton miles

Table VI-5

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY Nonmetallic Minerals
ALTERNATIVE Trendlong2003A

SEGMENT	EXP/IMP	1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	562	580	614	654	700	752	787	1.2	1.4
	Imports	1,230	1,286	1,582	1,779	1,977	2,247	2,430	2.9	2.4
Illinois River	Exports	282	306	352	405	466	536	584	2.8	2.8
	Imports	164	171	211	250	292	333	378	3.3	3.2
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	965	976	998	1,023	1,051	1,084	1,106	0.5	0.6
	Imports	1,667	1,751	2,203	2,565	2,945	3,428	3,761	3.4	3.0
Gulf Coast East	Exports	12,499	12,987	13,804	10,784	7,769	4,760	2,958	1.1	9.5
	Imports	2,551	2,786	3,533	3,872	4,229	4,681	4,995	3.3	2.0
Warrior River System	Exports	4	4	5	5	6	7	8	2.8	2.8
	Imports	1	1	2	2	2	3	3	1.0	3.1
South Atlantic Coast	Exports	2,730	2,887	3,168	2,959	2,779	2,634	2,566	0.6	1.1
	Imports	2,273	2,276	2,660	2,736	2,791	2,954	3,066	1.4	0.9
Middle Atlantic Coast	Exports	109	119	136	156	179	206	223	2.8	2.8
	Imports	5,258	5,308	6,115	6,703	7,069	7,701	8,142	1.9	1.5

Table VI-5 (continued)

SEGMENT	EXP/IMP	1977	1980*	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Exports	3	3	3	4	4	5	5	2.7	2.7
	Imports	1,044	1,074	1,307	1,479	1,662	1,83[illegible]	[illegible]	2.[illegible]	2.6
Great Lakes and Seaway	Exports	3,500	3,807	4,379	5,037	5,794	6,665	7,219	2.8	2.8
	Imports	2,208	2,262	2,501	2,729	2,978	3,2[illegible]9	[illegible],489	1.6	1.[illegible]
Washington/Oregon Coast	Exports	1,107	1,204	1,384	1,593	1,832	2,107	2,292	2.8	2.8
	Imports	1,902	1,967	2,258	2,454	2,650	2,916	3,[illegible]8	2.0	1.8
Columbia Snake Willamette River	Exports	111	121	139	160	184	211	230	2.8	2.8
	Imports	1,021	1,050	1,182	1,284	1,388	1,524	1,61[illegible]	1.8	1.8
California Coast	Exports	858	933	1,073	1,234	1,419	1,632	1,[illegible]5	2.8	2.8
	Imports	1,323	1,414	1,864	2,080	2,273	2,583	2,78[illegible]	3.5	2.3
Alaska	Exports	166	181	208	239	275	316	344	2.8	2.8
	Imports	24	25	27	29	32	34	36	1.5	1.6
Hawaii and Pacific Territories	Exports	19	21	24	28	32	37	40	2.8	2.8
	Imports	45	46	50	52	53	55	57	1.[illegible]	0.7
Domestic Caribbean	Exports	118	120	122	124	127	130	132	0.4	0.5
	Imports	273	286	356	410	466	538	588	3.2	2.8
Total	Exports	23,031	24,247	26,410	24,404	22,61[illegible]	21,[illegible]83	20,299	0.4	1.4
	Imports	20,985	21,705	26,051	28,425	30,807	34,182	[illegible],514	2.4	1.9

* = less than 500 tons

VII - FOOD AND KINDRED PRODUCTS

INDUSTRY OUTLOOK

Food and kindred products comprise a wide range of products for direct human consumption (meat, canned goods, wine, etc.) and for input to further processing (flour, meal, oils, animal feeds, etc.). The National Waterway Study food and kindred product forecasts were developed for three component groups - vegetable oils, grain mill products, and other food products. Vegetable oil and grain mill product production and exports are related to activity in domestic and foreign demand markets as well as production and prices of raw materials such as wheat, soybeans, and corn. Other food products are forecast based on population, disposable income and the other determinants of consumption activity.

(a) Industry Background

1. Vegetable Oils. Soybean oil and cottonseed oil are the major vegetable oils produced in the United States as a product of the oilseed crushing industry. Soybean oil production grew from 2.6 million tons in 1965 to 4.4 million tons in 1977 (5.7 million tons in 1979). Cottonseed oil production amounted to 630 thousand tons in 1977, down from 987 thousand tons in 1965, but consistent with levels through the 1970s. Exports play a strong role in both markets, with soybean oil exports equalling 1.3 million tons in 1979 (21.9% of production) and cottonseed oil exports equal to 317 thousand tons (50.2% of production). In each case, the export share is higher than the average during the early 1970s. The United States also imported over 1 million tons of vegetable oils in 1977, almost double the level of the beginning of the decade.

2. Grain Mill Products. The largest components of grain mill products - at least from a waterways perspective - are oilseed meals, flour, and prepared animal feeds. Production of soybean meal, the largest component, more than doubled between 1965 and 1979 (11.5 million tons to 25.0 million tons), while exports were enjoying a three-fold increase (from 2.2 million tons to 6.7 million tons) - 26.8% of production. Much of this

increase in soybean meal production came from the development of crushing plants in the prime growing areas of Iowa and Illinois.

Flour production was very stable through the 1960s and early 1970s, staying in the 12.2-12.9 million ton range from 1965 through 1975 before increasing to 14.2 million tons in 1979. Exports of flour amounted to 1.0 million tons in 1979 (7.4% of production) up roughly 50% from mid-1970s.

Exports of prepared animal feeds reached 1.2 million tons in 1977 after fluctuating between 750 thousand and 950 thousand tons per year between 1965 and 1975. No separate data concerning production of animal feeds, which range from mixed cattle feeds to dog food, is available.

3. Other Food Products. The Federal Reserve Board industrial production indices for food and kindred products grew at a 3.4% annual compound rate from 1965 to 1977. During this same period, real consumer expenditures on food increased almost 2% per year, while food, feed, and beverage imports were growing at 1.9% per year, and exports increased at 5% per year.

(b) National and Regional Forecasts

1. Vegetable Oils. Soybean oil production is projected to increase by 92% between 1977 and 2003, reaching 8.5 million tons at the end of the forecast period. Soybean oil exports grow by only 57.6% between 1977 an 2003, due to slower growth in the non-soybean-based components.

Vegetable oil imports are projected to increase by 139% between 1977 and 2003, reaching 2.4 million tons at the end of the forecast period. Between 1969 and 1977, the Atlantic Coast share of vegetable oil imports fell from 60% to 31%, while the Pacific Coast and Gulf Coast gained share (from 22% and 15% respectively in 1969 to 30%-35% in 1976-1977). This regional shift is expected to continue in the forecast period, with the Pacific and Gulf Coast shares reaching 40% and the Atlantic Coast accounting for only 20% in 2003.

2. Grain Mill Products. Soybean meal production is forecast to increase 86.4% between 1977 and 2003 (19.1 million tons to 35.6 million tons), with exports accounting for 6.9 million of the 9.7 million ton increase in supplies. Total grain mill product exports increase by 132% between 1977 and 2003 (a 2.9% per year compound growth rate) spurred by even more rapid growth in prepared animal feeds. The Gulf share of grain mill product exports, which grew from 55%-57% in the early 1970s to 82.4% in 1977 at the expense of all other coastal areas, is expected to level off in the forecast period - in part due to market saturation (82% is hard to improve upon), and in part because of the relatively rapid growth of Southeast soybean production which should spur export activity on the Atlantic Coast.

3. Other Food Products. The industrial production index for food and kindred products is projected to increase 97% over the forecast period, spurred by a 66.8% increase in constant dollar consumer expenditures on food and a 228% increase in constant dollar food, feed, and beverage exports. Food, feed, and beverage imports grow at a compound annual rate of 3.5%, increasing by 160% between 1977 and 2003.

(c) Key Industry Developments

The forecasts described above relate to potential shifts in dietary patterns and world living standards. The growth of foreign trade in general and feed-related exports in particular during the forecast period is based on a steadily improving standard of living abroad and consequent increases in meat consumption and feed demand. Continued concentration of wealth in low population areas and a prolonged slowdown in the world economy could postpone this phenomenon and reduce food and feed exports.

A second risk to the forecasts is supply-related. The grain mill product and vegetable oil projections described above are based on the relatively optimistic agriculture scenario described in the discussion of farm products forecasts elsewhere in this report. If the United States cannot achieve the projected agricultural production levels, then exportable surpluses of processed food products will be lower than described above.

Table VIII-1

Industry Forecast for Food and Kindred Products - Scenario @trendlong2003A
(1000 Tons)

	1977	1980	1985	1990	1995	2000	2003	% Compound Annual Growth 1977 to 1990	1990 to 2003
Soybean Oil									
Production	4,418.1	6,051.2	6,031.7	6,177.7	6,621.1	7,955.2	8,490.7	2.6	2.5
Exports	872.6	1,092.5	1,312.0	1,378.9	1,449.2	1,523.2	1,569.3	3.6	1.0
Soybean Meal									
Production	19,079.0	25,920.1	25,841.9	26,430.2	28,203.3	33,496.1	35,603.5	2.5	2.3
Exports	4,606.5	7,055.7	8,266.2	10,771.5	11,211.5	12,743.9	13,922.9	6.8	2.0
Other Food Products - in Billions of Dollars									
Personal Expenditures for Food (1972 Dollars)	165.1	169.8	190.5	211.4	235.3	259.9	277.7	1.9	2.1
U.S. Exports of Foods, Feeds, and Beverages (1967 Dollars)	9.3	11.4	15.3	19.0	23.2	27.8	30.5	5.7	3.7
U.S. Imports of Foods, Feeds, and Beverages (1967 Dollars)	5.5	6.1	7.4	8.7	10.5	12.7	14.3	3.6	3.9
Industrial Production Index - Foods (1967 = 1.00)	1.38	1.51	1.77	2.01	2.24	2.54	2.74	2.9	2.4

DISTRIBUTION SYSTEMS

The distribution system analysis for food and kindred products focuses on the role of waterborne transportation in food and kindred delivery system.

(a) Role of Water Transportation

1. Vegetable Oils. Waterborne transportation of vegetable oils is overwhelmingly oriented toward foreign trade. First, the 1.4 million tons of waterborne exports and 1.0 million tons of imports accounted directly for two-thirds of the total waterborne demand in 1977. In addition, a large share of domestic waterborne transportation of oils involves the collection or distribution of import/export traffic. For example, domestic soybean oil unloadings at Lower Mississippi River ports accounted for 680 thousand tons of 853 thousand tons (80%) of inland waterway barge traffic, and local traffic in the New York Harbor area, which results from oil imports in that area, accounted for another 262 thousand tons.

2. Grain Mill Products. The role of water transportation in grain mill product distribution systems is similar to that described for oils above. Thus, 57.2% of total waterborne transportation demand for grain mill products in 1977 was accounted for by exports. Additionally, 5.8 million tons out of 6.5 million tons of domestic inland barge traffic were unloaded at Lower Mississippi River ports.

The relatively minor remaining flows include a very stable 200-250 thousand tons moving lakewise on Lake Michigan and flows of 150-200 thousand tons destined for the Tennessee River, Hawaii, and Puerto Rico.

3. Other Food Products. Waterborne traffic activity in other food products also has a heavy foreign trade orientation, as well as a significant volume of traffic between the United States mainland and domestic offshore areas (Hawaii, Puerto Rico, and Alaska). In 1977, imports of 12.1 million tons directly accounted for over 50% of waterborne tonnage of other food products. Imports covered a wide variety of products including sugar (5.7 million tons), molasses (2.1 million tons), and alcoholic beverages (1.0 million tons). Exports, including tallow

and animal by-products (710 thousand tons), accounted for an additional 4.5 million tons, or 18.6% of waterborne traffic. This foreign trade was distributed across all port ranges including 2.7 million tons at Lower Mississippi River ports, 3.0 million tons at New York, and 494 thousand tons at Southern California ports.

Within the Mississippi River system, 1.5 million out of 1.9 million tons of barge traffic originated in the Lower Mississippi River area between Baton Rouge, New Orleans, and Morgan City. Most of that domestic movement, a third of which was local to the port complex, was connected with import/export activity. Other inland domestic destinations included the Illinois, Upper Mississippi, and Missouri Rivers, which accounted for 410, 165, and 178 thousand tons respectively in 1977. Major commodities in the inland traffic in 1977 were sugar (943 thousand tons) and molasses (800 thousand tons), and ice (454 thousand tons).

Finally, there were 4.5 million tons of coastwise traffic in 1977, most of which was between the domestic offshore regions and the mainland. Thus, Hawaii accounted for 2.0 million tons of domestic waterborne food and kindred product shipments in 1977 (mostly sugar, molasses, and prepared pineapples), and 855 thousand tons of receipts spread across a wide range of consumables. The domestic Caribbean shipped 471 thousand tons in 1977 and received 1.1 million tons, with the latter again representing non-perishable consumer food items.

(b) Factors Affecting Mode Choice

In the case of the overwhelming majority of waterborne traffic - foreign trade and offshore traffic - modal choice is not an issue, since the only alternative - air - is much more costly, making it a viable option only for perishables traffic. For inland waterway traffic, where rail and truck options exist, decisions are based on a combination of factors including origin and destination locations, cost, transit time and reliability, and other commodity-specific factors.

First, for grain mill products and vegetable oils (particularly soybean products), the concentration of major processing facilities in the Upper Mississippi River basin (with its relatively direct waterway link to the Gulf) and the export orientation of a large share of the traffic combine to favor water transportation to Gulf export ports. Approximately 100% of the growth in grain mill product exports through the 1970s was directed to Gulf ports, and nearly all of it was delivered by barge. Rail, on the other hand, is favored for movements of meal into domestic feeding areas such as the Southeast or consuming areas for flour and cereals, where water transportation is indirect or non-existent.

Second, cost considerations currently favor the choice of barge transportation for bulk food commodities in markets that are served by both rail and barge. While railroads have developed some very competitive rates for export grain in major growing areas, rates on grain products have tended to be higher, even though barge rates per ton tend to be comparable between grain and products.

Transit times and minimum shipment sizes discourage use of water transportation for the movement of non-bulk food products, because of their relatively high value (and implicit inventory costs), perishability, and non-suitability for bulk loading and unloading. These same factors often also argue against choice of rail in food movements.

One final factor in modal choice which favors barge in the movement of grain mill products to export ports has to do with their textural uniformity, and consequent suitability for mid-stream loading. Port congestion at Gulf ports puts a premium on this technology, which demands no vessel berth space. Dust and product integrity problems related to loading and unloading grain mill products also favor barge over rail, since transloading can be more readily accomplished in a single operation (barge-to-ship) as opposed to barge-to-storage-to-ship).

(c) Distribution System Developments

Several industry factors could affect the characteristics of the food and kindred product distribution system and the waterborne traffic demand projections in the following section. Foremost, potential congestion at Upper Mississippi locks (particularly at Locks and Dam 26) could inhibit growth of barge grain mill product traffic. The fact that loading facilities are being improved just below the facility at Alton will soften this problem, but a significant share of river traffic in food and kindred products utilizes Locks and Dams 26.

Second, rail deregulation could alter rail rate structures for processed grains in water-competitive markets and encourage their movement by rail. While at least one shipper interviewed for the NWS is anticipating rail deregulation by increasing truck and barge investments, some of the more interesting rail rate developments have been for the movement of processed grains to barge terminals, so the impact could go either way.

WATERBORNE DEMAND PROJECTIONS

Projections of the demand for waterborne transporteaion of food and kindred products are built up from separate forecasts for vegetable oils, grain mill products, and other food products. As noted above, a large share of domestic waterborne flows is related to foreign trade activity at Lower Mississippi River ports. These flows are projected based on forecasts of food product imports and exports at Lower Mississippi River ports. The demand for waterborne transportation between segments which are not related to foreign trade activity is, in general, held at base year levels, in line with the historical flatness of these flows. The exceptions to this rule include "other" food products which tend to be oriented toward human consumption, and grow with population and expenditures on food.

(a) Summary

The demand for domestic waterborne transportation of food and kindred products increases from 15.6 million tons in 1977 to 23.6 million tons in 1990 (3.2% per year) on the basis of rapid growth (4.6% per year) in grain mill products and more modest growth (1.8% per year) in "other" food products. Between 1990 ad 2003, the demand for domestic waterborne transportation of food products slows to a 1.9% per year annual rate of growth, reaching 30.0 million tons in the latter year. This is considerably slower than the historical growth rate of 6% per year between 1969 and 1977, a growth rate which was stimulated by 9% growth in internal traffic for all food products and 14.7% per year for grain mill products. All three components of domestic demand show reduced growth after 1990, with grain mill products growing at 2.1% per year, vegetable oils at 1.4%, and 1.6% for "other."

Waterborne food and kindred product imports, which are dominated by the "other" component, grow by 3% per year between 1977 and 1990, and 3.9% thereafter, increasing from 13.3 million tons in the base year to 32.3 million tons in 2003.

Waterborne food and kindred product exports, which are dominated by grain mill products (9.5 out of 15.3 million tons in 1977), grow by 3.5% per year to 1990 based on strong exports of meal and prepared feeds. Between 1990 and 2003, waterborne export demand grows from 24.0 million tons to 30.1 million tons (1.7% per year), based on significant declines in growth rates for both mill products and vegetable oils.

(b) Major Market Shifts

Because of the strength of growth of food export activity at the Gulf, Lower Mississippi River port terminations continue to increase their dominance over domestic waterborne movements of food and kindred products, accounting for 9.7 out of 14.4 million tons of new traffic demand between 1977 and 2003. However, the incredibly rapid shift of meal export markets, with barge gathering to the Gulf, during the 1970s was so complete

that this area must now depend on overall market increases for growth, and cannot extract much additional growth by gaining incremental market shares.

Potential congestion at Locks and Dams 26 could inhibit the waterborne demand projections for food and kindred products in the Upper Mississippi and Illinois Rivers before 1990. These two rivers account for 1.2 million tons out of total new domestic waterborne traffic demand growth to 1990 of 7.9 million tons.

(c) Waterborne Flow Changes

Tables VII-2 through VII-5 present the waterborne demand projections for food and kindred products. Table VII-2 shows the domestic shipments and receipts for each of 22 reporting segments. Table VII-3 presents the domestic tonnage utilizing each segment within the Mississippi River system and Great Lakes, including inbound, outbound, local, and through traffic. No total is presented in this table because of the implicit double-counting of flows utilizing more than one segment. Table VII-4 exhibits the ton-miles generated on each segment for the traffic loading represented in the previous table. Ton-miles in 1977 may differ from data published elsewhere due to the level of aggregation of the NWS network used to generate distances. Projected ton-mile growth rates should be unaffected. Finally, Table VII-5 shows the projected food products import-export activity for each NWS reporting segment. The key role of bulk food exports in domestic waterborne transportation demand is reflected in the projected growth rates on the Mississippi River system. Thus, receipts at the Baton Rouge to Gulf segment grow at 4.7% per year to 1990, matched by a reduction of growth of inland barge originations (e.g., 2.0% on the Upper Mississippi River and 2.2% on the Arkansas).

The Gulf orientation of inland barge traffic has other interesting implications. For example, although only 1.4 million tons of food products (out of 15.6 million) were shipped or received on the Lower Mississippi segment (Cairo to Baton Rouge) in 1977, nearly half the domestic food product tonnage used the segment if through traffic is included, and more than half of the Mississippi River

and Great Lakes ton-miles for the product occur there - 4.9 billion out of 9.0 billion (54.4%). This pattern is enhanced through the projection period, as ton-miles on that segment grow at 4.3% per year to 1990, compared to 4.0% per year for total domestic food product ton-miles.

Domestic waterborne traffic demand, particularly the large offshore volumes, grows more slowly than on the Mississippi River system. For example, shipments from Hawaii grow by 2.0%-2.3% per year and receipts at the Islands grow by 2.4%-2.6% per year, reflecting the slower growth of human food products for domestic consumption.

Food product imports grow relatively rapidly over the forecast period, actually surpassing food product exports by the year 2000. Waterborne demand projections for the two macroeconomic alternatives are included in Appendix B.

Table VII-2

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY Food and Kindred Products
ALTERNATIVE Trend[illegible]

SEGMENT	IN/OUT	1977	[illegible]	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Shipped	1,486	1,828	2,127	2,635	2,784	3,140	3,4[illegible]	4.5	2.0
	Received	169	[illegible]	177	181	186	19[illegible]	1[illegible]	0.5	0.5
Lower Upper Mississippi	Shipped	1,818	2,272	2,653	3,386	3,585	4,08[illegible]	4,465	4.9	2.2
	Received	156	160	165	171	178	186	191	0.7	0.9
Lower Mississippi	Shipped	1,30[illegible]	1,636	1,924	2,424	2,567	2,915	3,176	4.9	2.1
	Received	128	130	135	140	146	15[illegible]	161	0.7	1.1
Baton Rouge to Gulf	Shipped	1,310	1,370	1,442	1,528	1,609	1,716	1,791	1.2	1.2
	Received	7,017	8,[illegible]	10,189	12,781	11,538	15,[illegible]	16,[illegible]	4.7	2.1
Illinois River	Shipped	556	674	776	961	1,014	1,143	1,210	4.3	2.0
	Received	471	486	505	525	549	5[illegible]	5[illegible]	0.8	1.[illegible]
Missouri River	Shipped	559	676	778	948	999	1,119	1,208	4.1	1.9
	Received	180	185	189	194	199	204	207	0.5	0.5
Ohio River	Shipped	3[illegible]	416	482	609	643	731	797	4.6	2.1
	Received	234	239	246	253	263	275	283	0.6	0.9
Tennessee River	Shipped	540	671	791	978	1,035	1,166	1,265	4.7	2.0
	Received	170	170	170	170	170	171	171	0.0	0.0
Arkansas River	Shipped	140	176	207	266	282	323	354	5.1	2.2
	Received	38	38	39	40	41	42	42	0.5	0.4
Gulf Coast West	Shipped	760	807	851	914	946	999	1,035	1.4	1.0
	Received	486	501	517	532	549	5[illegible]	581	0.7	0.7
Gulf Coast East	Shipped	450	483	520	562	595	641	6[illegible]	1.7	1.4
	Received	122	129	139	148	157	169	1[illegible]	1.5	1.4
Warrior River System	Shipped	88	95	101	111	115	123	128	1.8	1.1
	Received	37	37	37	38	38	38	38	0.1	0.1
South Atlantic Coast	Shipped	328	357	393	428	464	509	540	2.1	1.8
	Received	290	319	354	387	422	466	496	2.2	1.9
Middle Atlantic Coast	Shipped	1,289	1,398	1,541	1,672	1,816	1,990	2,107	2.0	1.8
	Received	984	1,064	1,171	1,267	1,376	1,505	1,532	2.0	1.8

Table VII-2 (continued)

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Shipped	62	66	72	78	84	91	96	1.8	1.6
	Received	32	34	36	38	40	43	45	1.4	1.3
Great Lakes and Seaway	Shipped	322	322	322	322	322	322	322	0.0	0.0
	Received	322	322	322	322	322	322	322	0.0	0.0
Washington Oregon Coast	Shipped	361	394	436	477	520	574	611	2.2	1.9
	Received	228	248	273	297	322	353	374	2.0	1.8
Columbia Snake Willamette River	Shipped	60	63	69	75	83	92	98	1.8	2.1
	Received	85	91	98	104	111	119	125	1.5	1.4
California Coast	Shipped	1,135	1,251	1,405	1,559	1,726	1,935	2,078	2.5	2.2
	Received	1,826	2,010	2,238	2,454	2,682	2,967	3,162	2.3	2.0
Alaska	Shipped	167	184	205	225	245	272	289	2.1	2.0
	Received	309	340	377	413	451	498	5[illegible]1	2.1	1.9
Hawaii and Pacific Territories	Shipped	2,069	2,279	2,543	2,705	3,064	3,393	[illegible],629	2.3	2.0
	Received	1,055	1,165	1,318	1,475	1,6[illegible]0	1,866	2,016	2.6	2.4
Domestic Caribbean	Shipped	494	528	568	606	646	696	730	1.6	1.4
	Received	1,295	1,393	1,515	1,630	1,755	1,[illegible]	2,017	1.8	1.7
Total	Shipped	15,634	17,948	20,209	23,558	25,142	27,991	30,0[illegible]	3.2	1.9
	Received	15,634	17,948	20,209	23,558	25,142	27,991	30,040	3.2	1.9

a - less than 500 tons

Table VIII-3

WATERBORNE DEMAND FORECASTS (TONS 1000'S)
MISSISSIPPI RIVER SYSTEM GREAT LAKES
DOMESTIC TRAFFIC INBOUND OUTBOUND LOCAL AND THROUGH
COMMODITY Food and Kindred Products
ALTERNATIVE [illegible]

SEGMENT	1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
Upper Mississippi	1,651	1,998	2,300	2,813	2,966	3,327	3,597	4.2	1.9
Lower Upper Mississippi	5,321	6,379	7,299	8,923	9,414	10,567	11,428	4.1	1.9
Lower Mississippi	7,691	9,335	10,770	13,280	14,032	15,819	17,151	4.3	2.0
Baton Rouge to Gulf	8,451	10,197	11,733	14,388	15,222	17,133	18,559	4.2	2.0
Illinois River	1,018	1,150	1,270	1,475	1,552	1,710	1,827	2.9	1.7
Missouri River	739	860	967	1,112	1,197	1,321	1,415	3.4	1.7
Ohio River	1,243	1,459	1,650	1,972	2,072	2,304	2,477	3.6	1.8
Tennessee River	709	843	961	1,148	1,204	1,336	1,435	3.8	1.7
Arkansas River	177	214	246	306	323	365	396	4.3	2.0
Gulf Coast West	866	919	969	1,039	1,077	1,138	1,180	1.4	1.0
Gulf Coast East	579	622	669	725	766	825	865	1.7	1.4
Warrior River System	125	132	138	148	153	161	167	1.3	0.9
Great Lakes	322	322	322	322	322	322	322	0.0	0.0

* = less than 500 tons

Table VII-4

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY: Food and Kindred Products
ALTERNATIVE: Trendlong2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	566	685	788	964	1,017	1,140	1,233	4.2	1.9
Lower Upper Mississippi	1,101	1,320	1,510	1,846	1,948	2,186	2,364	4.1	1.9
Lower Mississippi	4,905	5,949	6,860	8,455	8,938	10,071	10,918	4.3	2.0
Baton Rouge to Gulf	964	1,156	1,325	1,616	1,708	1,918	2,075	4.1	1.9
Illinois River	253	285	315	366	386	425	454	2.9	1.7
Missouri River	451	525	590	696	730	807	863	3.4	1.7
Ohio River	247	279	309	361	379	419	448	3.0	1.7
Tennessee River	256	304	347	414	435	483	518	3.8	1.7
Arkansas River	62	75	86	107	113	128	139	4.3	2.0
Gulf Coast West	88	97	106	120	125	136	144	2.4	1.4
Gulf Coast East	16	17	18	20	21	22	23	1.9	1.2
Warrior River System	4	4	4	4	4	5	5	1.3	0.9
Great Lakes	88	88	88	88	88	88	88	0.0	0.0
Total	8,999	10,784	12,346	15,058	15,891	17,827	19,271	4.0	1.9

a = less than 500,000 ton miles

Table VII-5

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY Food and Kindred Products
ALTERNATIVE Trendlong2003A

SEGMENT	EXP IMP	1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	8,246	9,919	11,410	13,961	14,709	16,501	17,844	4.1	1.9
	Imports	2,649	2,763	3,357	3,986	4,846	[illegible]	6,669	3.2	4.0
Illinois River	Exports	230	[illegible]	308	372	392	437	471	3.8	1.8
	Imports	23	24	23	34	41	50	56	3.0	3.3
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	1,094	1,235	1,393	1,586	1,663	1,813	1,922	2.9	1.5
	Imports	1,000	1,011	1,247	1,475	1,785	2,165	2,440	3.0	3.9
Gulf Coast East	Exports	712	837	955	1,161	1,223	1,370	1,480	3.8	1.9
	Imports	396	408	492	581	702	851	958	3.0	3.9
Warrior River System	Exports	113	132	151	183	193	216	233	3.8	1.9
	Imports	42	43	48	54	62	72	79	2.0	2.9
South Atlantic Coast	Exports	532	577	642	709	741	790	840	2.2	1.3
	Imports	554	570	689	814	985	1,104	1,115	3.0	3.9
Middle Atlantic Coast	Exports	1,394	1,532	1,709	1,924	2,016	2,190	2,317	2.5	1.4
	Imports	5,951	6,138	7,189	8,696	10,479	12,656	14,225	3.0	3.9

Table VII-5 (continued)

SEGMENT	EXP/IMP	1977	1980	1985	YEAR 1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
North Atlantic Coast	Exports	53	54	59	63	66	63	72	1.4	1.1
	Imports	720	742	898	1,093	1,287	1,562	1,760	3.0	4.0
Great Lakes and Seaway	Exports	470	525	588	682	716	788	841	2.9	1.6
	Imports	69	71	87	102	124	151	170	3.0	4.0
Washington/Oregon Coast	Exports	621	701	789	925	972	1,073	1,149	3.1	1.7
	Imports	130	134	163	192	233	282	318	3.0	4.0
Columbia Snake Willamette River	Exports	150	157	172	185	193	206	216	1.6	1.2
	Imports	131	140	169	200	241	293	330	3.3	3.9
California Coast	Exports	1,604	1,724	1,908	2,091	2,187	2,348	2,464	2.1	1.3
	Imports	1,190	1,252	1,511	1,784	2,157	2,616	2,948	3.2	3.9
Alaska	Exports	11	12	13	13	14	15	15	1.2	1.0
	Imports	26	27	31	36	41	51	56	2.5	3.5
Hawaii and Pacific Territories	Exports	9	10	11	12	13	14	15	2.2	1.4
	Imports	33	34	39	45	53	63	70	2.5	3.4
Domestic Caribbean	Exports	103	116	130	151	159	175	187	3.0	1.6
	Imports	390	400	469	543	643	765	854	2.6	3.5
Total	Exports	15,344	17,802	20,238	24,019	25,256	28,012	30,065	3.5	1.7
	Imports	13,305	13,776	16,620	19,605	23,682	28,673	32,278	3.0	3.9

a = less than 500 tons

VIII - LUMBER AND WOOD PRODUCTS

INDUSTRY OUTLOOK

The Lumber and Wood Products Industry Model incorporates indicators of demand for lumber and plywood including projections of the total number of households, housing starts, mobile home shipments, expenditures on repairs and alterations, nonresidential building contracts, and industrial production. These indicators are combined with forecasts of lumber and wood use factors which are determined based on equations that incorporate own price, substitute prices, and final product (e.g., a house) as well as technological change. Total lumber and wood demands are forecast by combining the indicator projections and the wood use factor forecasts.

Regional production forecasts are determined by dividing United States consumption over the supply regions (including Canada) based on delivering prices in the four demand regions - Northeast, North Central, South and West. The delivered prices for each region are a function of mill prices being determined in large part by manufacturing costs.

(a) Industry Background

The most important factor in the demand for lumber and wood products is the demand for housing, a highly volatile and cyclical market. In the long run, however, steady growth is evident for the demand of lumber and wood products, disallowing for the peak and trough effects of the housing industry. The lumber and wood products industry operates in a very competitive atmosphere and is often viewed as the classic example of pure competition since there are a large number of relatively small producers. Entry and exit of the market is quite common because of the large numbers. This allows for a very competitive price structure for the product as well as a shifting mix and location of producers over time.

Lumber and plywood are the key commodities in the lumber and wood products industry, although wood chips,

fuel wood, and posts are also important by-products of the industry. Log exports are also a key component of the industry with 12.4 million tons of logs exported in 1977, 92% of which went to Japan. Major end-use markets for lumber and plywood, other than housing, include non-residential construction, industrial, and repairs and alterations. The importance of these three end-markets for the entire industry has been growing with respect to the three housing end-markets: single-family homes, multifamily homes, and mobile homes. The trend is expected to continue, especially in light of high mortgage rates which will have an adverse effect on new housing starts (if the high rates are temporary), but should bolster demand for lumber and wood products by the repairs and alterations market.

(b) National and Regional Forecasts

Softwood lumber and plywood demand are the key factors forecast for the lumber and wood products industry. United States lumber and plywood consumption made up close to 50% of total log consumption in 1977. The demand forecasts for lumber and plywood, both regionally and nationally, are presented in Table VIII-I, along with waterborne export and import projections for the key commodities.

Total lumber demand will grow from 38.5 million tons in 1977 to 53.4 million tons in 2003. Less than half of this growth will occur in the first part of the period - 1977 to 1990 - averaging annual growth of 1.2%. The average annual compound growth rate will increase somewhat from 1990 to 2003 to 1.4%. The majority of this growth is attributed to a significant increase in western demand for lumber as well as a sustained growth in demand for lumber in the South from 1977 to 2003. Demand will fall slightly in the Northeast and remain almost constant in the North Central region from 1977 to 1990. During the period 1990 to 2003, the average annual growth rates for each of the four demand regions will range between 1.2% and 1.5%, indicative of a resurgence in home-building and home demand.

Plywood demand will not fare as well, facing stiff competition from waferboards and oriented strandboards.

Table VIII-1

LUMBER AND WOOD INDUSTRY FORECASTS
Scenario Trend[illegible]

(Thousands of Tons)

	Years							% Annual Compound Growth	
	1977	1980	1985	1990	1995	2000	2003	1977 TO 1990	1990 TO 2003
SOFTWOOD LUMBER DEMAND									
Northeast	5,406.1	5,049.9	5,029.7	[illegible]	5,223.7	5,668.9	6,007.0	-0.7	1.5
North Central	9,546.2	9,275.6	9,692.1	[illegible]	10,119.5	10,961.6	11,524.1	0.0	1.5
South	14,227.2	14,073.5	15,957.4	16,[illegible]4.8	17,699.6	18,876.0	19,776.3	1.3	1.2
West	9,339.4	10,852.9	12,542.2	13,[illegible]9.5	14,120.2	15,162.9	15,966.1	2.8	1.4
U.S. TOTAL	38,518.9	39,251.9	43,[illegible]1.4	41,765.6	47,161.0	50,669.4	53,373.6	1.2	1.4
SOFTWOOD PLYWOOD DEMAND									
Northeast	1,362.4	1,208.0	1,030.7	830.2	752.9	712.5	696.8	-3.7	-1.3
North Central	2,322.2	2,047.8	1,779.1	1,428.5	1,279.4	1,208.2	1,176.6	-3.7	-1.5
South	3,107.4	3,408.1	3,817.0	3,800.0	3,794.1	3,816.6	3,827.3	1.4	0.1
West	2,445.9	2,631.9	2,963.3	2,964.8	2,950.2	2,972.3	2,983.1	1.5	0.0
U.S. TOTAL	9,317.9	9,296.6	9,598.1	9,023.6	8,776.6	8,709.5	8,683.7	-0.2	-0.3
WATERBORNE EXPORTS	22,858.8	20,754.1	21,839.9	18,478.8	17,323.1	16,845.9	16,552.3	-1.6	-0.8
Logs	12,428.9	10,308.2	10,333.1	7,274.7	6,777.4	6,777.4	6,777.4	-4.0	-0.5
Lumber & Plywood	1,935.3	2,413.1	2,258.2	2,285.7	2,280.9	2,293.8	2,293.8	1.3	0.0
Wood Chips	8,191.8	7,721.0	8,920.3	8,574.7	7,903.9	7,395.8	7,090.9	0.4	-1.5
Other	302.8	311.8	327.4	343.8	361.0	379.0	390.2	1.0	1.0
WATERBORNE IMPORTS	6,542.7	5,842.4	7,333.6	7,256.2	7,205.5	8,058.5	7,830.5	0.8	0.6
Lumber & Plywood	4,435.8	3,735.5	5,226.7	5,149.3	5,098.6	5,951.6	5,723.6	1.2	0.8
Other	2,106.9	2,106.9	2,106.9	2,106.9	2,106.9	2,106.9	2,106.9	0.0	0.0

Total plywood demand will decline an average of -0.2% per year from 1977 to 1990, and will decline an average of -0.3% per year from 1990 to 2003. Both the Northeast and the North Central will experience the sharpest declines, each registering -3.7% average annual rates of decline from 1977 to 1990. Similarly, the two regions will have average annual declines in demand of -1.3% and -1.5%, respectively. Both regions will consume barely half of their 1977 plywood consumption in 2003. On the other hand, plywood demand in the South and West will increase at an average annual rate of growth of 1.4% and 1.5%, respectively, from 1977 to 1990. After 1990, however, actual growth will be negligible out to 2003.

Waterborne exports of lumber and wood products will decline throughout the forecast, averaging annual declines of -1.6% from 1977 to 1990 and slowing somewhat from 1990 to 2003 to -0.8% average annual declines. This decline in exports from 22.9 million tons in 1977 to 16.6 million tons in 2003 will be led by a severe decline in log exports. Log exports are expected to fall an average of -4.0% per year from 1977 to 1990 and -0.5% per year from 1990 to 2003. The major cause of this decline is an expected deterioration in Japanese demand for United States logs. This phenomena will be discussed in more detail in the following section.

Waterborne exports of wood chips, the other major export commodity for lumber and wood products, will grow slightly from 1977 to 1990, increasing from 8.2 million tons to 8.6 million tons. From 1990 to 2003, however, wood chips exports will decline an average of -1.5% a year to 7.1 million tons in 2003. Lumber and plywood exports (only 8.5% of total exports in 1977) will grow an average of 1.3% per year from 1977 to 1990, while staying relatively level from 1990 to 2003, totalling 2.3 million tons (13.9% of total exports) in 2003. On the other hand, lumber and plywood comprised over 67% of total lumber and wood products imports in 1977. In most cases, these imports represent fulfillment of specialized needs and supplement demand when necessary. In 1977, lumber and plywood imports accounted for only 9.3% of total demand. This share is expected to be maintained throughout the forecast period, reflective of their specialized usage in the United States.

In sum, total lumber and wood products demand, exports and imports will, in the long run, be largely stable with slow constant growth. Exceptions to this will be lumber demand in the West from 1977 to 1990, which will grow at average annual rates of 2.8%; log exports from 1977 to 1990, which will decline at average annual rates of -4.0% per year; and plywood demand in the Northeast and North Central regions throughout the forecast period, which will decline an average of -2.6% per year. These exceptions are due largely to changing demographics and are offset by varying occurrences in other regions and commodities. These industry developments will be discussed in more detail below.

(c) Key Industry Developments

Two factors which have begun to impact the lumber and wood products industry and which will continue to do so throughout the forecast period are a shift to southern timber sources and a decline in demand for logs by the Japanese. Both of these developments will have the affect of significantly changing the industry.

A strong shift to production of southern timber is occuring and is expected to continue through 2003. Georgia-Pacific is moving its headquarters from Portland, Oregon, to Atlanta, Georgia, a move which exemplifies the renewed interest in southern timber as well as a depletion of western timber resources. A move to southern production of lumber and wood products will be a necessary outcome of the move to increased harvesting of southern timber due to the fact that the industry tends to locate close to the resources for maximum productivity. The largest impacts of this regional shift to the South will be felt primarily by the Pacific Northwest producers of lumber and plywood. These producers will be forced to the South because private timber sources are plentiful there (87.5% of the total commercial timber inventory) while the Pacific Northwest standing timber volume is primarily National Forest owned (59.7%). Therefore, Pacific Northwest lumber and wood products producers, working with a dwindling forest stand, will generally supply the western region in the future and the southern producing region will supply the Northeast, North Central and South regional demands.

The second industry development will help to offset the Pacific Northwest's timber supply problem to some degree. This development will be the decreased Japanese demand for United States logs which will free up some timber resources for domestic consumption. Japan is currently the largest importer of United States timber but its own timber resources are expected to increase dramatically by the turn of the century while housing construction will fall following the bullish demographics in the early 1980s. Therefore, Japanese domestic resources will be relied upon more heavily as the forecast period progresses. As Japanese demand for United States logs falls, Pacific Northwest resources should increase at a similar rate because this region is the exclusive supplier of logs for export to Japan. The effects of these two key industry developments on the distribution system of lumber and wood products will be discussed within the Distribution System section.

DISTRIBUTION SYSTEM

Rail transportation of lumber and wood products has, historically, been the predominant modal choice of the industry. Motor carriers have been making significant inroads to this market recently, however, largely due to the shift to a more intra-regional distribution process, especially in the West. Waterborne distribution of these products is a relatively minor consideration when analyzing the distribution of lumber and wood products. Only in the case of imports and exports do the waterways play a major role in the transportation of the products to their applicable end-markets. This lack of dependence on the waterways for transportation from mill to end-use market has been due, in the past, to the location of the industry in the Pacific Northwest and the location of the end-markets predominantly in the North Central, Northeast, and the South. Although waterways have been used in the past for this West to East move (shipments from the West Coast to the East Coast via the Panama Canal), economics have dictated a reliance on railroad and motor carrier for the major transportation needs. Future reliance on the waterways may be increased, however, due to the shift in timber sources to the South from the West as well as a shift to intra-regional distribution patterns.

(a) Role of Water Transportation

As mentioned above, the waterways do not play a major role in the distribution of lumber and wood products domestically. For example, in 1977, only 0.7% (0.23 million tons) of total United States lumber production was transported on the internal waterways while 1.3% (0.13 million tons) of total plywood production moved on the inland waterways. Coastal shipments for lumber reached 1.22 million tons in 1977 (3.9% of total production) while coastal shipments for plywood were 0.11 million tons (1.1% of total production). Great Lakes traffic displayed similar patterns to coastal and internal waterways traffic patterns in 1977. Exports, however, represented a significantly higher percentage of lumber production and a somewhat higher percentage of plywood production. In 1977, exports of lumber totaled 1.76 million tons (5.7% of total producton) while plywood exports totaled 0.17 million tons (1.7% of total production).

Domestic and export water movements of logs, on the other hand, accounted for 31.2 millon tons of the 52.8 million tons of lumber and wood products transported on the waterways in 1977. The majority of the 31.2 million tons was either rafted logs moving in the Pacific Northwest (16.3 million tons - 52%) or export logs (12.4 million tons - 40%). Rafted logs are second-quality logs which are primarily chipped by pulp mills. The majority of export logs go to Japan where lumber is made and consumed by the Japanese or sold to other countries, including the United States. The Japanese timber stand is maturing, however, which may impact future log exports from this country.

(b) Factors Affecting Modal Choice

Origin-destination patterns of lumber and wood products have a major impact on modal choice as do modal prices. In general, a movement of products from the Pacific Northwest to the Northeast, North Central and South regions would be by railroad. For example, according to the Western Wood Products Association[1], in 1978, 99.3% of coastal lumber shipments to the Northeast moved by rail while 90.1% of coastal shipments destined

for the North Central region were transported by rail. Coastal lumber shipments to the South moved almost exclusively by rail in 1978 - 99.3% of total shipments. In the West, however, the majority of coastal lumber shipments moved by truck - 57.8% - while 42.1% of the total shipments from the coastal region to the West moved by rail.

Modal shares for shipments from the Inland region (Arizona, California, Colorado, Idaho, Montana, New Mexico, Nevada, Eastern Oregon, South Dakota, Utah, Eastern Washington, and Wyoming) are similar for termination in the Northeast (99.4% by rail), but are somewhat lower for North Central terminations (70.4% by rail and 29.6% by truck) as well as for South terminations (82.2% by rail and 17.8% by truck). In addition, truck is the overwhelming modal choice when shipping lumber from the Inland region to the West with trucks moving 70.7% of all such shipments.

In the southern producing region, the majority of shipments are distributed within the region and to the Northeast and North Central regions; only a small percentage of shipments go to the West. According to the Southern Forest Products Association[2], 77% of southern pine shipments were distributed by truck in 1978 while 23% moved by railroad. These figures, plus the western modal share estimates for the coastal and inland producing regions, indicate the dependence of the industry on distance for its modal decision.

(c) Distribution System Developments

Waterways may be relied on to a greater extent in the future for the distribution of lumber and wood products

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1 "Destination of Shipments of Western Wood Species by State," Western Wood Products Association, Portland, Oregon. January 16, 1979.

2 "Distribution of Southern Pine Shipments," Southern Forest Products association, New Orleans, Louisiana. March, 1979.

due to a number of industry phenomena. In addition, lumber and wood products industry is presently showing a growing discontent with both the railroad and trucking industries. The railroads are slow and inefficient in the opinion of a number of representatives of the forest product industry, largely as a result of poor railcar availability in the Pacific Northwest. The costs of trucking products is also becoming a major concern for members of the lumber and wood products industry, largely due to increasing fuel prices. Many of these industry representatives feel that water movement may be the mode of the future because of its charateristically low cost of operation. In light of this perception on the part of the industry, an increase in construction of facilities located on the water is expected both in the South and the Pacific Northwest.

A shift to a more regional marketing of products in the Pacific Northwest is also expected to be a factor in the increased usage of the waterways. Competition between truck and barge could be of greater significance under a shift to regional movements due to the fact that demand for railroad services would decrease and the remaining two modes would be most useful for the industry's short hauls. Coastal movements by barge may also be advantageous in the future in that they are fairly flexible and inexpensive. If fuel costs increase significantly, there would also be an even larger shift to barge in order to minimize costs. Producers would most likely use barge for the largest part of the trip when possible and then transload onto truck (or move by truck and then transload to barges for the major part of the trip).

The shift to southern timber resources will, in all likelihood, create a number of new opportunities to ship by water which have not exisited until now. The construction of new facilities to take advantage of the southern resources and the decision on where to build the facilities will be based largely on the present transportation costs being incurred by southern producers. The southern waterways offer a far wider range of distribution patterns than the Pacific Northwest waterways in that they can deliver products to points in the North Central, South Central, and Northeast regions of the country.

WATERBORNE DEMAND PROJECTIONS

The first step in forecasting lumber and wood products traffic on the waterways was to identify the significant import/export flows in light of the fact that these flows are the major contributors to waterborne demand. The second step was to aggregate the 66 analysis segments into seven "super segments." These segments are: Internal; East Coast; United States Great Lakes; West Coast; Hawaii and Caribbean; Imports/Exports; and Canadian Great Lakes. Coastal shares for imports and exports were adjusted to reflect the shifts expected to occur over the projection period. The Lumber and Wood Products Industry forecasts for exports and imports were then applied to these adjusted coastal shares.

Domestic flow forecasts were derived for all of the commodities (except rafted logs) based on the relevant production and demand levels for the individual products. For example, the growth rate for lumber production in the Douglas Fir region was applied to 1977 West Coast lumber waterborne flows to determine future West Coast lumber flows. Another example is that the growth rate for total southern plywood shipments to the South was appplied to internal 1977 waterborne plywood flows to determine future plywood traffic flows. Flows of under 50,000 tons in 1977 were projected by averaging historical flows to get a 2003 level and then increasing or decreasing tonnage out to that level. In the case of rafted logs, an econometric equation was estimated. The major explanatory variables in the equation include lumber production in the Douglas Fir region, plywood production in the West and pulp production in the West.

(a) Summary

The majority of lumber and wood products shipped or received on the domestic waterways network can be found in the Pacific Northwest on the Washington/Oregon Coast, the Columbia-Snake-Willamette River system and the Alaskan Coast. This will be the case for the entire projection period - 1977 to 2003 - although some gains will be found on the Mississippi River system, the Tennessee River, and the Warrior River system. Previously established waterway movements of lumber and wood products in the Pacific

Northwest will, however, remain the primary source of waterborne shipments and receipts.

The movement of rafted logs accounts for the majority of domestic shipments and receipts on the three Pacific Northwest river segments (Washington/Oregon Coast, the Columbia-Snake-Willamette River system, and the Alaskan Coast). In addition, lumber and other wood products (including fuel wood, wood chips, posts and piles) also contribute over one million tons each to shipments and receipts. In general, domestic lumber and wood products traffic is intra-segment so that shipment and receipt tonnage is similar by segment.

Total domestic traffic tonnage for lumber and wood products will grow from 23.4 million tons in 1977 to 29.9 million tons in 2003, representing an annual average growth rate of 0.9% over the 26 year period. The figures for total traffic, domestic and foreign, are more than twice as much as domestic tonnage in 1977, 52.8 million tons, but total traffic only grows to 54.2 million tons in 2003, an average annual rate of growth of 0.1%. These figures reinforce the importance of import/export flows on total lumber and wood products waterway traffic. A more substantial growth in domestic flows will, however, be the dominating factor in the future for lumber and wood products waterway traffic.

(b) Major Market Shifts

Spurred by the shift to the production of southern timber, import/export coastal shares will experience major changes from 1977 to 2003. Log exports will continue to originate primarily on the West Coast, although the East Coast will gain 1.8% more of the market. This gain is clearly diminished, however, by the fact that log exports will fall significantly from 1977 to 2003. A more defined shift can be observed in lumber exports.

The West Coast is expected to originate 60% of total lumber exports in 2003 as opposed to 80% in 1977. The Gulf Coast and the East Coast will gain most from the shift, increasing their market share from close to 20% to 40% in 2003. Therefore, although lumber exports will

increase slightly, the West Coast will originate less tonnage in 2003 than in 1977 while the East Coast segments will originate more. The West Coast will, on the other hand, import more lumber on a percentage basis in 2003 in order to supplement declining production in the region. Alternately, the South will become more self-sufficient and will only receive 42% of the import lumber in 2003 whereas in 1977 the regions' waterways terminated 52% of the import lumber.

Market shares of plywood exports will be similar in that the West Coast will originate only 50% of plywood exports while the southern waterways will originate 48.5% of plywood exports. In 1977, the shares were 28.9% for the South and 69.3% for the West Coast. Plywood import shares are expected to remain unchanged based on the fact that most plywood imports are hardwood - a specialty item which will not significantly change in distribution or tonnage in the future.

More wood chips and other wood products will be exported form southern waterways (20% of 2003 tonnage as opposed to 7.6% of 1977 tonnage) while the West Coast will originate less tonnage due to a decreased market share (75.5% in 2003 rather than 91.9% in 1977) as well as a decrease in tonnage being exported. Again, imports will remain constant, both with respect to market share and tonnage.

Domestic flows will not display any major shifts largely due to the fact that waterborne transportation is generally the third choice by the industry behind railroad and truck. In the case of a shift in production to the South, a more dramatic shift from railroad to truck will be seen rather than from railroad and truck to barge and vessel transportation. This does not mean that southern waterways will not experience an increase in demand, only that the gains will be to a lesser degree than might be expected. The West Coast waterways will maintain their strength, largely on the basis of continued traffic tonnage generated by rafted logs. Southern waterways patterns are not established at this time and will take time to do so, thereby explaining the slower shift in domestic traffic to this area.

(c) Waterborne Flow Developments

Waterborne demand projections are presented in Tables VIII-2 through VIII-5 for lumber and wood products. Table VIII-2 includes all domestic traffic by segment, both shipped and received. The majority of waterborne flow developments will occur from 1977 to 1990 with segment traffic increases or decreases averaging between 0.8% and 5.1% per year. In terms of actual tonnage, waterborne traffic on the West Coast will grow most significantly, gaining between 600,000 tons (Alaskan shipments) and 2,657,000 (Columbia-Snake-Willamette River shipments) from 1977 to 1990. In percentage growth terms, Upper Mississippi receipts will increase an average of 5.1% per year and shipments will increase an average of 3.4% a year. Lumber and wood products shipments and receipts on the Alaskan Coast will also grow at a rapid pace, averaging annual rates of growth of 2.7% for shipments and 2.4% for receipts. This growth is largely attributed to the growth in demand for rafted logs by pulp mills in Alaska as well as in Washington and Oregon. Tonnage declines on the South Atlantic and Middle Atlantic Coast are indicative of the decline in foreign-related domestic traffic historically generated in these regions. Growth rates for the period 1990 to 2003 are seldom above 1.0%, indicating extremely slow growth for lumber and wood products domestic waterborne traffic in those years.

Total domestic traffic - shipped, received, and through - for segments comprising the Mississippi River system as well as the Great Lakes is presented in Table VIII-3. A similar story is told by these numbers with slow to moderate growth evident in all segments except the Upper Mississippi segment tonnage which grows at an average annual rate of 3.0% from 1977 to 1990. Altogether, however, this traffic accounts for only 9.5% of total domestic traffic in 1977 (2.2 million tons), 8.7% of total domestic traffic in 1990 (2.5 million tons) and 9.0% of total domestic traffic in 2003 (2.7 million tons). East Coast and West Coast domestic traffic make up the remaining 90% or so of the total.

Domestic traffic ton-miles for these same Mississippi River and Great Lakes segments reflect similiar growth rates as seen in Table VIII-3. Declines in ton-miles are

Table VIII-2

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY: Lumber and Wood Products
ALTERNATIVE: [illegible]2003A

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
Upper Mississippi	Shipped	12	17	19	19	20	20	21	3.4	0.5
	Received	7	12	14	14	15	15	15	5.1	0.6
Lower Upper Mississippi	Shipped	18	19	20	21	21	21	22	1.0	0.4
	Received	23	23	26	[illegible]	27	27	28	[illegible]	[illegible]
Lower Mississippi	Shipped	441	454	506	512	528	544	552	1.1	0.6
	Received	428	459	498	501	513	528	536	1.2	0.5
Baton Rouge to Gulf	Shipped	140	142	164	161	167	173	174	1.1	0.6
	Received	136	136	149	152	156	160	162	0.9	0.5
Illinois River	Shipped	20	21	22	22	22	23	23	0.7	0.3
	Received	78	[illegible]	[illegible]	[illegible]	96	[illegible]	102	1.1	1.0
Missouri River	Shipped	3	3	3	3	3	3	3	1.2	[illegible]
	Received	0	0	0	0	0	0	0	0.0	0
Ohio River	Shipped	35	36	39	40	42	43	43	1.2	0.5
	Received	a	a	a	a	a	a	a	0.4	0.9
Tennessee River	Shipped	361	374	410	419	431	444	450	1.2	0.6
	Received	361	374	410	419	431	444	450	1.2	0.6
Arkansas River	Shipped	12	12	14	14	14	15	15	1.2	0.6
	Received	5	5	5	5	5	5	5	1.0	0.5
Gulf Coast West	Shipped	65	64	66	66	66	66	67	0.1	0.1
	Received	37	35	32	31	30	29	28	[illegible]	0.8
Gulf Coast East	Shipped	13	12	11	14	15	15	16	[illegible]	0.7
	Received	101	106	114	117	121	121	126	1.2	0.5
Warrior River System	Shipped	431	447	491	502	517	512	510	1.2	0.6
	Received	284	298	322	330	338	[illegible]	352	[illegible]	[illegible]
South Atlantic Coast	Shipped	726	680	647	591	551	516	494	1.6	1.4
	Received	393	367	328	294	264	[illegible]	222	2.2	[illegible]
Middle Atlantic Coast	Shipped	311	305	383	380	412	441	[illegible]	[illegible]	[illegible]
	Received	679	611	684	658	683	[illegible]	[illegible]	[illegible]	0.5

Table VIII-2 (continued)

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Shipped	a	a	a	a	a	a	a	0.8	1.1
	Received	a	a	a	a	a	1	1	1.8	1.9
Great Lakes and Seaway	Shipped	177	161	161	160	161	161	161	0.8	0.0
	Received	177	161	160	160	161	161	161	0.8	0.0
Washington/Oregon Coast	Shipped	8,948	11,183	10,521	11,112	11,143	11,408	11,483	1.7	0.3
	Received	7,991	10,429	9,577	10,150	10,147	10,397	10,469	1.9	0.2
Columbia Snake Willamette River	Shipped	9,790	12,636	11,706	12,418	12,447	12,720	12,873	1.8	0.3
	Received	9,562	12,456	11,494	12,204	12,228	12,550	12,653	1.9	0.3
California Coast	Shipped	30	25	30	30	31	32	32	0.1	0.3
	Received	810	633	795	812	838	847	847	0.0	0.3
Alaska	Shipped	1,556	2,136	2,058	2,187	2,217	2,286	2,311	2.7	0.4
	Received	1,731	2,276	2,239	2,370	2,408	2,483	2,510	2.4	0.4
Hawaii and Pacific Territories	Shipped	76	84	100	106	113	120	125	2.6	1.2
	Received	280	253	303	311	323	332	337	0.8	0.6
Domestic Caribbean	Shipped	6	5	3	3	2	2	2	-6.1	2.6
	Received	121	116	134	134	139	144	145	0.8	0.7
Total	Shipped	23,204	28,815	27,377	28,780	28,922	29,638	29,858	1.7	0.3
	Received	23,204	28,815	27,377	28,780	28,922	29,638	29,859	1.7	0.3

a = less than 500 tons

Table VIII-3

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL, AND THROUGH
COMMODITY: Lumber and Wood Products
ALTERNATIVE: Traditional2003A

SEGMENT	1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
Upper Mississippi	15	20	22	22	23	24	24	3.0	0.6
Lower Upper Mississippi	133	128	161	151	159	166	167	1.0	0.8
Lower Mississippi	555	569	641	643	665	686	695	1.1	0.6
Baton Rouge to Gulf	190	188	217	213	221	228	230	0.9	0.6
Illinois River	98	94	123	112	118	125	125	1.1	0.8
Missouri River	3	3	3	3	3	3	3	1.2	0.5
Ohio River	35	37	40	41	42	43	44	1.2	0.5
Tennessee River	361	374	410	419	431	444	450	1.2	0.6
Arkansas River	12	13	14	14	15	15	15	1.1	0.6
Gulf Coast West	72	71	73	72	72	73	73	0.0	0.0
Gulf Coast East	124	127	140	142	146	150	152	1.0	0.5
Warrior River System	444	457	502	512	527	542	549	1.1	0.5
Great Lakes	177	161	160	160	161	161	161	0.8	0.0

a = less than 500 tons

Table VIII-4

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON MILES
MISSISSIPPI RIVER SYSTEM GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY Lumber And Wood Products
ALTERNATIVE [illegible]

SEGMENT	1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
Upper Mississippi	3	3	3	3	3	4	4	0.8	0.6
Lower Upper Mississippi	25	24	31	29	30	32	32	1.0	0.8
Lower Mississippi	137	137	162	158	164	171	172	1.1	0.7
Baton Rouge to Gulf	25	24	29	28	29	30	30	0.8	0.7
Illinois River	26	24	32	29	31	33	33	1.1	0.8
Missouri River	a	a	1	1	1	1	1	1.2	0.5
Ohio River	13	14	15	15	16	16	16	1.2	0.5
Tennessee River	42	43	48	49	50	51	52	1.2	0.6
Arkansas River	1	1	1	1	1	1	1	1.2	0.6
Gulf Coast West	2	2	2	2	2	2	2	-1.0	0.5
Gulf Coast East	9	9	10	10	10	10	11	1.0	0.5
Warrior River System	45	47	51	52	54	55	56	1.2	0.5
Great Lakes	45	40	40	40	40	40	40	0.0	0.0
Total	373	369	424	416	431	449	449	0.8	0.6

a = less than 500,000 ton miles

Table VIII-5

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY: Lumber and Wood Products
ALTERNATIVE: Trend1ong2034

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	108	117	146	148	157	167	168	2.5	1.0
	Imports	175	149	187	171	171	185	182	0.1	0.5
Illinois River	Exports	5	5	6	5	5	5	5	1.0	0.0
	Imports	1	1	1	1	1	1	1	0.2	0.1
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	274	323	510	597	631	635	636	6.2	0.5
	Imports	208	181	230	213	213	232	228	0.2	0.5
Gulf Coast East	Exports	35	63	85	98	107	112	113	8.3	1.1
	Imports	77	68	94	93	92	107	103	1.5	0.8
Warrior River System	Exports	111	160	206	235	259	275	277	5.9	1.3
	Imports	93	82	108	110	109	125	120	1.3	0.7
South Atlantic Coast	Exports	441	556	788	891	951	974	980	5.6	0.7
	Imports	600	522	634	582	572	613	601	-0.2	0.2
Middle Atlantic Coast	Exports	257	325	448	432	447	467	476	4.1	0.7
	Imports	1,414	1,180	1,527	1,456	1,390	1,572	1,512	0.2	0.3

Table VIII-5 (continued)

SEGMENT	EXP/IMP	YEARS 1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-03	90-03
North Atlantic Coast	Exports	11	13	19	16	16	16	17	2.7	0.5
	Imports	251	213	284	275	260	300	286	0.4	0.3
Great Lakes and Seaway	Exports	50	60	322	398	405	412	406	17.3	0.1
	Imports	9	8	8	8	7	7	7	1.6	0.6
Washington/Oregon Coast	Exports	13,485	11,826	11,934	9,530	8,731	8,410	8,233	2.6	1.1
	Imports	2,689	2,529	3,013	3,193	3,227	3,609	3,516	1.3	0.7
Columbia Snake Willamette River	Exports	5,470	4,816	4,853	3,881	3,556	3,427	3,353	2.6	-1.1
	Imports	160	140	177	162	164	178	175	0.1	0.6
California Coast	Exports	1,579	1,446	1,504	1,322	1,196	1,120	1,076	1.4	1.6
	Imports	479	419	581	579	589	682	660	1.5	1.0
Alaska	Exports	989	1,001	938	839	779	744	733	1.3	1.0
	Imports	233	230	240	240	241	247	246	0.2	0.2
Hawaii and Pacific Territories	Exports	40	38	44	43	40	37	36	0.5	-1.1
	Imports	8	7	10	10	10	11	11	1.2	0.8
Domestic Caribbean	Exports	5	6	7	8	7	7	7	3.9	0.2
	Imports	158	134	188	188	186	218	209	1.3	0.8
Total	Exports	22,859	20,754	21,812	18,442	17,285	16,808	16,515	-1.6	-0.8
	Imports	6,565	5,864	7,361	7,283	7,232	8,088	7,859	0.8	0.6

* = less than 500 tons

evident for both the GIWW West and the Great Lakes segments, -1.0% to 1990. Ton-miles on the remaining segments will grow an average of 0.8% per year to 1.2% per year from 1977 to 1990, slowing to 0.5% to 0.8% average annual growth from 1990 to 2003. The most glaring fact from both the domestic traffic ton and ton-mile figures is that the insignificant amount of domestic lumber and wood products waterways traffic has existed and is expected to exist. The waterways are only suitable in very specialized cases for lumber and wood products transportation, a fact reflected in the ton and ton-mile levels.

Foreign trade, on the other hand, is significantly more important in tonnage terms, especially on the West Coast, as seen in Table VIII-5. The four West Coast segments (Washington/Oregon Coast, Columbia-Snake-Willamette River, California Coast and Alaska) accounted for 21.5 million tons, 93.8% of total exports in 1977, the majority of which were logs. By 2003, these four segments will account for 13.4 million tons, only 80.8% of total exports, reflecting both the decline in log exports as well as the shift in exports to southern waterways. Alternately, the share of imports for these four West Coast segments will increase from 54.2% (3.6 million tons) in 1977 to 58.5% (4.6 million tons) in 2003, indicative of the Pacific Northwest's need to reinforce its production capability with imports.

Import/export flows and rafted logs in the Pacific Northwest are the two most important factors when considering total lumber and wood products waterborne flows. Therefore, the major risks of the waterborne demand projections for lumber and wood products lie within the assumptions made for these concepts. For example, if log exports do not fall as dramatically as estimated here, total waterborne traffic will grow at somewhat faster rates of growth because log exports are such a large contributor to total flows. Alternately, if environmental restraints restrict the rafting of logs in the Pacific Northwest, total domestic flows could be seriously affected based on the fact that rafted logs accounted for 69.6% of the domestic flows in 1977 and will comprise 71.6% of the domestic flows in 2003.

IX - PULP, PAPER AND ALLIED PRODUCTS

INDUSTRY OUTLOOK

The Pulp, Paper and Allied Products Industry Model focuses on two major importing areas - on Western Europe and Japan, and on the North American and Scandanavian exporters. Domestic demand, exports, production, and prices forecast for the United States Paper groups offered in the model include: printing and writing papers; newsprint; and wrapping and packaging papers and board. Two chemical pulp grades are included: bleached and semi-bleached sulfate and bleached sulfite. Major end use markets factored into the model include: for newsprint - newspaper circulation, newspaper advertising lineage and commercial printing activity; for coated two-sided papers - book publishing, commercial printing and magazine advertising pages; and for pulp - the production of paper and board products multiplied by the conversion factors which relate to the tonnage of each pulp consumed by the product. These factors, combined with inventory changes, are input to determine apparent consumption.

(a) Industry Background

The pulp, paper and allied products industry is one of international scope with a great deal of interplay between countries. Demand for printing and writing papers, including newsprint, largely responds to worldwide demands in printed media advertising. Pulp producers, in turn, adjust their production to be in tune with these demands.

The pulp and paper industry experienced significant gains during the 1960's, in large part due to the boom in advertising and computers. The 1970's industry performance in comparison, has been fairly lackluster, severely impacting business confidence in the pulp and paper sector. Recovery from the 1974-1975 recession has been slow and arduous, especially in Western Europe.

Supply and demand as well as substitutability play a major role in the pulp, paper and allied products industry. Because of this, the industry's performance is often

linked with the general economy's performance. Severe consumer inventory savings, combined with the worst recession in post-war history, slowed demand substantially from 1970 to 1978. In addition, the real price of paper and board fell as producers expanded the size of mills to capitalize upon economies of scale. Finally, plastic products made significant inroads during this time period to traditional Kraft papers, fibre box, and folding carton end-use markets. All of these factors combined for a somewhat poor performance over the last decade for the pulp, paper and allied products industry. The future, however, is expected to improve the outlook for the industry.

(b) National and Regional Forecasts

Pulp, paper and allied products national production forecasts are presented in Table IX-1. Regionality of these forecasts was not attempted due to a lack of regional data on which to base any regionalization as well as the need to focus more on the international supply and demand market for this particular industry.

Total United States pulp production is expected to grow at an average rate of 2.7% per year from 1977 to 1990 and 1.5% per year from 1990 to 2003. In tonnage terms, pulp production will grow from 50.0 million tons in 1977 to 85.8 million tons in 2003. Total paper and paperboard production will increase at somewhat faster rates during the forecast period, growing an average of 3.1% per year from 1977 to 1990 and 2.1% per year from 1990 to 2003. This growth will be led during the first part of the forecast period by paper production (3.3% average annual growth from 1977 to 1990) and by paperboard production during the latter years of the forecast period (2.2% average annual growth from 1990 to 2003).

Newsprint production will grow at a faster rate than any other paper or paperboard grade from 1977 to 1990, averaging 5.0% annual growth, and increasing from 3.9 million tons to 7.3 million tons. This growth is largely attributable to a continued advertising boom in the printed media. Other paper grades such as coated printing papers, uncoated freesheet papers and unbleached groundwood papers

Table IX-1

PULP, PAPER AND ALLIED PRODUCTS INDUSTRY FORECASTS
Scenario-TrendFl-ng2003A

(Thousands of Tons)

	Years 1977	1980	1985	1990	1995	2000	2003	% Annual Compound Growth 1977 TO 1990	1990 TO 2003
PRODUCTION									
WOOD PULP	50,009.3	53,781.6	64,131.2	70,913.8	76,030.1	81,964.2	85,770.0	2.7	1.5
PAPER GRADES	27,381.3	29,753.1	36,180.6	41,891.0	46,068.7	51,450.8	54,469.3	3.3	2.0
NEWSPRINT	3,867.6	4,579.5	6,030.5	7,272.9	8,154.1	8,936.3	9,447.6	5.0	2.0
COATED PRINTING PAPERS	4,261.9	4,756.6	6,155.8	7,288.7	8,398.3	9,191.3	9,696.6	4.2	2.2
UNCOATED FREESHEET PAPERS	6,815.0	7,653.0	9,543.3	11,453.5	13,271.3	15,135.9	16,396.4	4.1	2.8
UNBLEACHED GROUNDWOOD PAPERS	1,289.9	1,345.2	1,839.7	2,325.2	2,746.9	3,093.5	3,331.3	4.6	2.8
BRISTOLS	1,031.8	1,038.0	1,142.4	1,229.3	1,314.3	1,417.0	1,490.5	1.4	1.5
THIN PAPERS	348.4	364.0	429.0	496.5	518.4	559.6	584.1	2.6	1.4
COTTON FIBRE PAPERS	103.6	109.5	118.1	120.4	132.1	135.2	139.3	1.2	1.1
BLEACHED KRAFT PAPERS	835.5	792.4	845.1	889.4	903.6	916.3	930.1	0.4	0.3
UNBLEACHED KRAFT PAPERS	3,815.4	3,920.6	4,313.7	4,706.6	5,044.2	5,451.2	5,750.9	1.6	1.6
TISSUE PAPERS	4,285.0	4,538.3	4,914.9	5,251.6	5,457.2	5,653.4	5,738.6	1.6	0.7
SPECIAL INDUSTRIAL PAPERS	486.5	496.4	575.7	642.6	695.7	740.0	769.2	2.2	1.4
GLASSINE AND GREASEPROOF PAPERS	230.6	211.8	222.5	224.1	232.6	221.1	214.5	-0.2	-0.3
PAPERBOARD GRADES	34,631.9	36,892.8	44,391.4	50,014.0	55,280.4	61,815.6	66,230.6	2.9	2.2
UNBLEACHED KRAFT PAPERBOARD	13,652.1	15,048.9	18,969.6	21,910.0	24,715.4	28,226.8	30,664.8	3.7	2.6
BLEACHED PAPERBOARD	3,721.7	3,923.9	4,245.6	4,572.8	4,881.0	5,103.5	5,211.4	1.6	1.0
SEMICHEMICAL CORRUGATING MEDIUM	4,264.1	4,600.0	5,683.1	6,581.4	7,507.7	8,654.3	9,401.8	3.4	2.8
RECYCLED PAPERBOARD	7,316.6	7,683.1	9,354.4	10,546.0	11,646.0	13,077.1	14,000.3	2.9	2.2
BUILDING PAPERS AND BOARD	5,467.9	5,428.3	5,930.3	6,194.4	6,320.8	6,544.5	6,742.8	1.0	0.7
OTHER BOARD	209.5	209.5	209.5	209.5	209.5	209.5	209.5	0.0	0.0
TOTAL PAPER AND PAPERBOARD	62,013.2	66,645.9	80,572.0	91,905.0	102,149.1	113,266.4	120,699.9	3.1	2.1

will also benefit from this advertising boom. Coated printing papers production will average 4.2% annual growth from 1977 to 1990 while uncoated freesheet papers production will average 4.1% growth during that period and unbleached groundwood papers production will grow an average of 4.6% per year from 1977 to 1990. Unbleached Kraft paperboard will be the stellar performer within the paperboard grades with production averaging 3.7% annual growth from 1977 to 1990 and 2.6% average annual growth from 1990 to 2003. In addition, semichemical corrugating medium production will average 3.4% per year growth from 1977 to 1990 and 2.8% average annual growth from 1990 to 2003.

On the whole, pulp, paper and allied products production is expected to rebound from the doldrums experienced in the 1970's. Only one product - glassine and greaseproof papers - will experience production declines. These declines, however, are both small (-0.2% per year from 1977 to 1990 and -0.3% per year from 1990 to 2003) and relatively unimportant in tonnage terms - only 230,600 tons in 1977 (0.8% of total paper production).

(c) Key Industry Developments

Capacity expansion in the United States South will be the major industry development during the forecast period. This increase in capacity in the South by the pulp, paper and allied products industry will be largely necessitated by the lumber and wood products industry shift to consumption of plentiful Southern timber as opposed to the dwindling Pacific Northwest timber stock. Because the pulp industry relies on the lumber and wood products industry for its raw materials (wood chips and/or second quality logs suitable for chipping) and, in turn, the paper and paperboard industry relies on the pulp industry, it stands to reason that the three will tend to locate near each other, whenever possible.

Other industry trends which will begin to develop in the 1980's and continue through the century will include the following:

1. The highest demand growth for pulp, paper and allied products, at least in percentage terms, will shift to Latin America, Africa, and Asia;

2. New technological developments, especially in electronics, will negatively impact paper usage; and

3. Worldwide demand growth will slow to match the performance recorded in the 1970's.

DISTRIBUTION SYSTEM

Over 90% of the pulp produced in this country is consumed by paper and paperboard producers close by and, therefore, does not require elaborate distribution systems. The other 10% is generally transported by railroad or exported. Railroad and truck are the two modes used primarily for the distribution of paper and paperboard with barge transportation running a minimal third. Railroads have experienced some decline in market share to motor carriers but not to the extent exhibited in the lumber and wood products industry (1977 rail share of total paper and paperboard products was 60%). As in the case of lumber and wood products, waterborne transportation of pulp, paper and allied products is most important when analyzing import/export flows. The United States is actually a net importer of many pulp and paper grades due to a dependence on Canadian supplies. The majority of Canadian imports come into this country by railroad although some tonnage does get transported on the Great Lakes, the East Coast and the West Coast.

(a) Role of Water Transportation

Pulp, paper and allied products waterborne transportation largely consists of 100-300 mile flows which are usually the origination or termination of an export or import flow. In 1977, only 840,000 tons of pulp (1.7% of total United States pulp production) was transported on the internal waterways. Coastal movements accounted for only slightly more than one-eighth of that tonnage (120,000 tons - 0.2% of total United States pulp production) while

lakewise traffic of pulp consisted of 45,000 tons in 1977, an insignificant percent of production. Internal water shipments of paper and paperboard, including newsprint, were somewhat more substantial, totalling 2.1 million tons in 1977 - 3.5% of total United States paper and paperboard production. Coastal shipments were again weak for these products with only 500,000 tons evident in 1977 (0.8% of total United States production). Lakewise traffic for paper and paperboard products was somewhat less significant at 389,000 tons or 0.6% of total United States production.

Exports of both pulp and paper and paperboard products accounted for the major portion of waterborne tonnage in 1977. Close to 2.6 million tons of pulp in 1977 were oceanborne exports, 5.1% of total production. In the case of paper and paperboard products, almost 2.5 million tons were oceanborne exports in 1977, 4.0% of total production.

These figures clearly point out the key role exports play in waterborne transportation of pulp, paper and allied products. Besides exports, waterborne transportation of these products is relatively insignificant both in relation to total production and to total waterborne tonnage, all commodities.

(b) Factors Affecting Modal Choice

Origin-destination patterns as well as modal availability are the primary factors affecting modal choice by the pulp, paper and allied products industry. In general, barge transportation is not the industry's choice because of its relative inflexibility with respect to truck and, to a lesser degree, railroad. Unless railroad and truck rates are extremely out of line, waterborne rates cannot compete due to the fact that the products will, in most cases, require transloading prior to or after the waterborne trip. Transloading adds both time and additional costs to the waterborne transportation of pulp, paper and allied products. In addition the products are generally transported either very long distances, in which case railroad is the most cost effective choice, or very short distances, in which case truck is the most cost effective choice.

(c) Distribution System Developments

The shift to Southern production of timber will impact the present distribution system of pulp, paper and allied products by shifting the industry's resource base. Because pulp producers rely on wood chips from the lumber mills (or rafted logs so they can do their own chipping), the pulp industry tends to locate near the pulp producers from whom they get their raw materials. Therefore, with the lumber and wood products industry moving to the South, the pulp, paper and allied products industry will follow to the extent possible.

Two factors which may inhibit an all out shift of the industry to the South are the costs associated with relocating the industry and the inability to receive rafted logs on the Southern waterways. Pulp and paper mills are capital intensive and, therefore, not as easily mobile as a lumber mill. In order to move the pulp, paper and allied products industry South, a significant investment will be required. Although it appears that a portion of that investment will be made, a good share of the industry will also remain in the Pacific Northwest.

The second factor limiting the relocation of the pulp, paper and allied products to the South is the fact that log rafting opportunities would be severly limited by the Southern waterway characteristics. Over 16 million tons of logs were rafted in the Pacific Northwest in 1977, almost all of which went to pulp mills. Log rafting is not presently found on the Southern waterways and is not expected to become a significant part of log transportation in the South because of the environmental problems associated with the log rafting (e.g., log dumping, the first step in rafting, often results in debarking, which can cause water pollution from the pitch, as well as soil erosion along the banks). Therefore, many pulp producers will remain in the Pacific Northwest, where the log rafting pattern is already set.

Imports of pulp, paper and allied products are expected to decline in the future with domestic production increasing proportionately. This decline in imports could mean some declines in tonnage on waterway segments which

are typically used for domestic termination of these imports. Internal waterborne traffic may, however, gain tonnage due to the increased domestic production.

WATERBORNE DEMAND PROJECTIONS

Import/export flows were identified as the major contributors to total pulp, paper and allied products waterborne tonnage; domestic segment tonnage represented less than half of the total flows in 1977. Based on this knowledge, the 66 analysis segments were aggregated into seven "super segments": Internal, East Coast, United States Great Lakes; West Coast; Hawaii and Caribbean, Imports/Exports; and Canadian Great Lakes. Coastal shares for imports and exports were adjusted to reflect the shifts expected to occur over the projection period. The pulp, paper and allied products industry forecasts for waterborne exports and imports were then applied to these adjusted coastal shares.

Domestic flow forecasts were derived for all of the commodities based on the national production growth for the individual commodities within the reporting segment. Flows of under 50,000 tons in 1977 were projected by averaging historical flows to get a 2003 level. Tonnage was increased or decreased over the 26 year period at a rate which reached the proper level in 2003.

(a) Summary

Total domestic traffic, all segments, totalled 4.055 million tons in 1977 (34.5% of total flows) with the Columbia-Snake-Willamette River accounting for over 1.7 million tons of the domestic traffic level. Demand for domestic waterborne transportation by the pulp, paper and allied products industry will grow at an average compound annual rate of 1.8% from 1977 to 1990 and 1.0% from 1990 to 2003. Segments displaying the largest growth in tonnage demand terms will be the Washington/Oregon Coast (2.3% from 1977 to 1990 and 1.2% from 1990 to 2003 for shipments and 2.5% from 1977 to 1990 and 1.3% from 1990 to 2003 for receipts) and the Columbia-Snake-Willamette River (2.2% from 1977 to 1990 and 1.1% from 1990 to 2003 for

shipments and 2.3% from 1977 to 1990 and 1.1% from 1990 to 2003 for receipts). By 2003, demand for domestic waterborne carriage for pulp, paper and allied products will be 5.9 million tons or 37% of total expected demand for both domestic and foreign traffic.

Total exports of pulp, paper and allied products totaled 5.0 million tons in 1977 (43% of total traffic) while imports accounted for 2.7 million tons of total traffic (23%) in 1977. Demand for import waterborne transportation will decline an average of -1.6% per year from 1977 to 1990 and -1.1% per year from 1990 to 2003. These average annual declines are indicative of the reduced reliance on imports which the pulp, paper and allied products industry is expected to experience over the next 26 years. Demand for export waterborne transportation will grow at close to historical rates, averaging annual growth rates of 2.2% from 1977 to 1990 and 1.4% thereafter.

(b) Major Market Shifts

There will be very few market shifts within the pulp, paper and allied products industry. The most noticeable will be a slight shift to increased production in the South (generally new capacity coming on line) and a slight reduction in imports over the forecast period. In terms of commodity mix, newsprint, coated printing papers and uncoated freesheet paper production will grow faster and become larger components of the total paper production figures than other paper grades. Unbleached Kraft paperboard and semichemical corrugating medium will be the big gainers in the paperboard industry. Total production of pulp, paper and paperboard will, however, be fairly standard, averaging 2.0% to 2.8% growth from 1977 to 2003.

Demand for transportation of these products will also remain fairly standard with no dramatic shifts expected. Southern waterways may gain some demand for traffic as a result of the increased production capacity estimated to locate there but the Pacific Northwest will continue to produce a significant amount of the total products and, therefore, require a significant amount of the total waterborne transportation demands. In 1977, domestic and export waterborne transportation of pulp, paper and allied products accounted for 8% of production. In 2003, this

percentage is expected to fall to 6.7% of production, largely due to the slow growth in demand for domestic waterborne transportation combined with the rapid growth in pulp, paper and allied products production. Motor carriers and railroads will be the major benefactors of this increased production.

(c) Waterborne Flow Developments

Table IX-2 presents the waterborne demand projections for domestic traffic (shipped and received) by the pulp, paper and allied products industry while Table IX-3 presents waterborne demand projections for the Mississippi River System/Great Lakes, all traffic (inbound, outbound, local and through). Ton-miles for this concept are presented in Table IX-4 and foreign traffic demand projections are found in Table IX-5.

As mentioned before, demand for domestic waterborne traffic, shipped and received, will grow an average of 1.8% per year from 1977 to 1990 and 1.0% per year from 1990 to 2003. Segments which will gain significant tonnage demand include the South Atlantic Coast (shipments), the Middle Atlantic Coast (receipts), the Washington-Oregon Coast (shipments and receipts), and the Columbia-Snake-Willamette River (shipments and receipts). These increases are fairly consistent with the comparable areas of growth for pulp, paper and allied products production.

Demand for waterborne domestic traffic (inbound, outbound, local and through) for the Mississippi River System/Great Lakes, on the other hand, will grow very slowly from 1977 to 2003 as seen in Table IX-3. Similarly, ton-mile growth on these segments will grow an average of 0.9% per year from 1977 to 1990 and 0.7% per year from 1990 to 2003 (see Table IX-4). These slow growth rates reflect the limited demand for waterborne carriage of pulp, paper and allied products despite significant production increases. The fact remains that waterborne transportation of these products is only strongly used in conjunction with foreign traffic. Any domestic use is purely convenience and generally atypical.

Table IX-2

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY: Pulp, Paper and Allied Products
ALTERNATIVE: TrendLong2003A

SEGMENT	IN/OUT	1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
Upper Mississippi	Shipped	1	1	1	1	1	2	2	2.4	2.1
	Received	14	14	15	16	16	16	16	0.8	0.4
Lower Upper Mississippi	Shipped	0		0	0	0	0	0	0.0	0.0
	Received	6	6	6	6	6	7	7	0.8	0.4
Lower Mississippi	Shipped	195	202	216	224	232	241	247	1.0	0.8
	Received	3	3	3	4	4	4	4	0.9	0.3
Baton Rouge to Gulf	Shipped	102	109	121	132	143	155	163	2.0	1.7
	Received	466	487	523	548	575	604	622	1.3	1.0
Illinois River	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	29	[illegible]	36	40	44	47	52	2.3	2.1
Missouri River	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	6	6	7	7	7	7	7	0.8	0.4
Ohio River	Shipped	3	3	3	3	3	3	3	0.8	0.4
	Received	13	14	14	15	15	15	16	0.8	0.4
Tennessee River	Shipped	163	171	185	195	205	217	225	1.4	1.1
	Received	131	138	150	159	169	180	187	1.5	1.3
Arkansas River	Shipped	118	122	128	131	133	136	138	0.8	0.4
	Received	4	4	4	5	5	6	6	2.4	2.1
Gulf Coast West	Shipped	47	49	52	54	56	59	60	1.1	0.9
	Received	39	40	42	42	43	44	45	0.7	0.4
Gulf Coast East	Shipped	138	145	157	166	176	186	193	1.4	1.2
	Received	28	29	31	32	34	35	36	1.1	0.8
Warrior River System	Shipped	17	18	20	21	23	25	26	1.8	1.6
	Received	9	9	10	11	11	12	12	1.1	1.1
South Atlantic Coast	Shipped	379	406	451	488	521	555	579	2.0	[illegible]
	Received	53	57	63	69	75	82	86	1.9	1.7
Middle Atlantic Coast	Shipped	108	108	114	119	125	130	134	0.8	0.9
	Received	254	272	304	325	348	372	387	1.9	1.4

Table IX-2 (continued)

SEGMENT	IN/OUT	1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
North Atlantic Coast	Shipped	2	2	3	3	3	3	3	1.8	0.8
	Received	1	1	1	1	1	1	1	1.8	1.0
Great Lakes and Seaway	Shipped	434	437	441	444	446	448	450	0.2	0.1
	Received	434	437	441	444	446	448	450	0.2	0.1
Washington Oregon Coast	Shipped	391	411	477	513	545	578	599	2.1	1.2
	Received	456	491	575	627	670	713	741	2.5	1.3
Columbia Snake Willamette River	Shipped	1,736	1,879	2,172	2,313	2,446	2,583	2,670	2.2	1.1
	Received	1,708	1,850	2,141	2,281	2,413	2,549	2,635	2.3	1.1
California Coast	Shipped	66	69	74	76	78	80	81	1.1	0.5
	Received	13	7	a	a	a	a	a	-29.7	2.5
Alaska	Shipped	115	123	146	163	176	188	197	2.7	1.5
	Received	20	22	26	27	29	30	31	2.1	1.0
Hawaii and Pacific Territories	Shipped	40	48	63	68	74	80	84	4.1	1.6
	Received	149	162	185	194	203	212	218	2.0	0.9
Domestic Caribbean	Shipped	9	9	10	11	11	11	12	1.4	0.7
	Received	217	233	262	273	285	299	306	1.8	0.9
Total	Shipped	4,055	4,312	4,841	5,124	5,398	5,683	5,866	1.8	1.0
	Received	4,055	4,312	4,841	5,124	5,398	5,683	5,866	1.8	1.0

a = less than 500 tons

Table IX-3

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM GREAT LAKES
DOMESTIC TRAFFIC INBOUND, OUTBOUND, LOCAL AND THROUGH
COMMODITY Pulp, Paper and Allied Products
ALTERNATIVE Trendlong2003A

SEGMENT	YEARS 1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	15	15	16	17	17	18	18	0.9	0.6
Lower Upper Mississippi	56	59	65	69	74	80	84	1.7	1.4
Lower Mississippi	369	383	408	424	441	458	470	1.1	0.8
Baton Rouge to Gulf	551	576	621	652	685	721	744	1.3	1.0
Illinois River	29	31	36	40	44	49	52	2.4	2.1
Missouri River	6	6	7	7	7	7	7	0.8	0.4
Ohio River	44	46	48	49	50	51	52	0.8	0.4
Tennessee River	163	171	185	195	205	217	225	1.4	1
Arkansas River	122	126	132	136	139	142	144	0.8	0.5
Gulf Coast West	68	70	74	77	80	83	85	1.0	0.7
Gulf Coast East	182	190	206	218	231	244	253	1.4	1.2
Warrior River System	26	27	30	32	34	36	38	1.6	1.4
Great Lakes	434	437	441	444	446	448	450	0.2	0.1

a = less than 500 tons

Table IX-4

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON MILES
MISSISSIPPI RIVER SYSTEM GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY: Pulp, Paper and Allied Products
ALTERNATIVE: [illegible]

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	7	8	8	8	8	9	9	0.9	0.6
Lower Upper Mississippi	12	13	14	15	16	17	18	1.7	1.5
Lower Mississippi	108	112	121	126	132	138	142	1.2	0.9
Baton Rouge to Gulf	65	58	63	66	63	73	75	1.3	1.1
Illinois River	1	3	3	4	4	5	5	2.4	2.1
Missouri River	4	4	4	4	4	4	a 4	0.8	0.4
Ohio River	11	10	10	11	11	11	11	0.8	0.4
Tennessee River	19	20	21	21	22	23	23	0.9	0.6
Arkansas River	10	11	11	12	12	12	12	0.8	0.5
Gulf Coast West	12	12	13	14	14	15	15	1.0	0.7
Gulf Coast East	29	31	33	36	38	40	42	1.5	1.3
Warrior River System	1	1	1	1	1	1	1	1.6	1.4
Great Lakes	119	120	121	122	122	123	123	0.2	0.1
Total	389	401	424	438	454	471	482	0.9	0.7

a = less than 500,000 ton miles

Table IX-5

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY: Pulp, Paper and Allied Products
ALTERNATIVE: Trend/Long2003A

SEGMENT	EXP/IMP	1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	929	918	1,117	1,227	1,352	1,459	1,512	1.1	1.8
	Imports	92	79	56	44	37	[illegible]	[illegible]	5.5	1.0
Illinois River	Exports	2	2	3	3	4	4	5	1.1	2.2
	Imports	72	74	77	78	80	82	83	0.6	0.5
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	261	287	346	388	436	471	502	3.1	2.0
	Imports	26	22	16	12	11	9	8	5.5	3.0
Gulf Coast East	Exports	260	287	347	387	428	467	496	3.1	1.9
	Imports	14	29	21	16	14	11	11	5.5	3.0
Warrior River System	Exports	142	158	195	210	229	244	256	3.0	1.5
	Imports	104	96	85	78	74	71	69	2.2	0.9
South Atlantic Coast	Exports	1,458	1,614	2,044	2,243	2,464	2,652	2,738	3.4	1.5
	Imports	359	335	302	275	254	237	228	2.0	1.4
Middle Atlantic Coast	Exports	389	428	527	595	659	725	768	3.3	2.0
	Imports	642	590	519	461	415	379	362	2.5	1.9

Table IX-5 (continued)

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Exports	64	71	89	99	109	118	123	3.3	1.7
	Imports	87	85	83	81	80	78	[illegible]	[illegible] 5	0.4
Great Lakes and Seaway	Exports	3	4	4	5	5	6	6	2.5	2.0
	Imports	345	346	352	348	345	342	341	0.1	0.1
Washington Oregon Coast	Exports	682	686	656	628	648	640	643	0.6	0.2
	Imports	242	237	230	220	210	202	198	[illegible]	0.8
Columbia Snake Willamette River	Exports	269	266	253	247	251	254	257	0.7	0.3
	Imports	1	1	1	1	1	1	1	1.6	1.4
California Coast	Exports	380	387	372	351	364	355	355	0.6	0.1
	Imports	606	580	542	502	466	433	423	1.4	1.3
Alaska	Exports	252	259	250	233	242	234	233	0.6	0.0
	Imports	13	12	12	11	10	9	9	1.5	1.4
Hawaii and Pacific Territories	Exports	a	a	a	a	a	a	a	2.6	2.0
	Imports	24	22	20	18	16	15	14	2.1	1.7
Domestic Caribbean	Exports	21	23	26	30	33	36	39	2.6	2.0
	Imports	37	34	31	28	25	23	22	2.1	1.7
Total	Exports	5,015	5,391	6,231	6,645	7,221	7,666	7,962	2.2	1.4
	Imports	2,483	2,341	2,146	2,174	2,037	1,935	1,878	1.6	1.1

a = less than 500 tons

Foreign traffic waterborne projections are presented in Table IX-5 and offer the most convincing statistics. The decline in imports is clearly defined here with Gulf port tonnage declining an average of 5.5% per year from 1977 to 1990 and 3.0% per year from 1990 to 2003. Atlantic Coast imports will fall an average of -2.0% to -2.5% a year from 1977 to 1990 and -1.4% to -1.9% a year from 1990 to 2003. On the West Coast, imports will fall an average of -1.5% from 1977 to 1990 and -1.0% from 1990 to 2003. These statistics all point to the decreased reliance the industry will have on overseas production. Exports will not increase drastically, however, with the increased domestic capacity expected to come on line, simply because the extra capacity can be used fully by domestic consumption (as pointed out before, the United States is presently a net importer of pulp, paper and allied products). Total waterborne demand for exports will grow an average of 2.2% per year from 1977 to 1990 and then slow to 1.4% average annual growth from 1990 to 2003. The majority of this growth will come from the Southern waterways where the extra capacity is expected to locate. Exports from the West Coast will actually decline slightly from 1977 to 2003.

The major risk of the waterborne demand projections is that they are too low. Growth is purposely held back based on the belief that waterborne transportation of pulp, paper and allied products is the third modal choice after railroad and truck. If this situation changes, either because of deregulation of the railroads or continued and more severe fuel problems for the motor carriers, waterborne transportation may become more attractive as a modal choice and therefore raise demand. Demand for waterborne transportation by the pulp, paper and allied products industry is not expected to change under the alternative scenarios, Badenergy2003A and Largergovt2003A as seen in Appendix B.

X - CHEMICALS

INDUSTRY OUTLOOK

The Chemical Industry Model employs a methodology which analyzes the chemical industry in the context of the larger energy and economic environment effects demands, supplies, and prices of chemicals. Econometric chemical end-product demand equations cover such end uses as plastics, elastomers, solvents, coatings, and surfactants. The demand models are constructed to capture the direct relationship between detailed economic indicators and finished product uses. The Supply and Pricing Submodel of the Chemical Industry Model is a structural model of the chemical industry, containing technological, economic, and capacity data by process. The Model is structured to account for the complex interaction between products and co-products. Linear programming techniques are used to solve the model, in which total costs are minimized subject to demand constraints, capacity contraints, internal process economics, and in-house industry knowledge. The model has been tested using historical data to assure its validity, and relates the demands for final products back to demands for intermediates and raw materials via the available process technologies. The methodology for deriving every, raw material, and chemical prices includes an analysis of the relationship between these prices and crude oil and natural gas prices, processing costs, supply/demand imbalances, and government regulations. Inherent to each forecast is a forecast of the Energy Model for energy demands and prices, which combined with forecasts of construction cost indices and wage indices are inputs to a refinery linear programming model whose output is used as the basis for the chemical price forecasts.

The Fertilizer Industry Model converts the demand for nitrogen and phosphate forecast by the Agriculture Industry model to demand for major fertilizer types (anhydrous ammonia, urea, nitrogen solutions, ammonium nitrate, concentrated superphosphate, DAP). This analysis was not performed for potassic fertilizers due to the relatively minor tonnages of potassic fertilizers moving by water.

(a) Industry Background

The United States chemical processing industry creates a broad range of over 1,000 commercially important products and compounds, which are not classified in a manner conducive to meaningful analysis by the CCDWC commodity coding system. Chemical products' production has outstripped GNP growth as chemicals and chemical based products (plastics, synthetic fibers, synthetic resins, fertilizers, pesticides, solvents, paints, coatings, and other items) have worked their way into a number of consumer, commercial, and industrial applications. Important historical growth trends have been the consistent expansion of chemical and chemical product markets, with growing substitution of metallic and agriculturally based products by chemical based synthetics, particularly petrochemicals, the development of products tailor-made for particular applications and use conditions with concurrent advancements in process technology, as well as increases in exports and imports in an increasingly international market.

(b) National and Regional Forecasts

Table X-I presents production indices for important CCDWC industrial chemical categories and consumption indices for important fertilizer chemical compounds. The results are presented for industrial chemicals in terms of indices and CCDWC codes rather than by named chemical compounds due to the problems associated with classification of chemicals under the CCDWC coding system and also due to the difficulty of presenting growth rates for many separate and unrelated chemicals in a concise format. The chemical categories which experience the highest growth rates include CCDWC 2811, Crude Tar, Oil and Gas Products, reflecting expected increases in production of coal based synfuels and coal based petrochemical feedstocks along with continued high demand for benzene, tolune, and xylene petroleum fractions, and urea, which is expected to exhibit high sustained growth in fertilizer applications. CCDWC 2813, Alcohols, and CCDWC 2817, Benzene and Toluene, also exhibit large increases in production for use as organic and petrochemical intermediates. Chemical categories exhibiting moderate growth rates include 'Other' chemicals, which include CCDWC 2819, Basic Chemicals and Basic Chemical Products NEC, CCDWC 2821, Plastic

Table X-1

National Chemical
Production and Consumption

Scenario @Trendlong2003A
Indices 1977 = 100.0
Source Chemical Model

	1977	1980	1985	1990	1995	2000	2003	% Compound Annual Growth 1977 to 1990	% Compound Annual Growth 1990 to 2003
Production of CCDWC Chemical Categories									
CCDWC '2810'	100.0	105.5	122.9	137.7	154.3	176.3	190.9	2.5	2.5
CCDWC '2811'	100.0	108.6	133.4	179.4	249.3	340.0	409.5	4.6	6.6
CCDWC '2813'	100.0	114.3	137.9	165.1	197.0	236.5	264.0	3.9	3.7
CCDWC '2817'	100.0	113.0	144.5	171.9	201.0	235.8	259.6	4.3	3.2
CCDWC '2818'	100.0	106.4	118.1	131.0	145.4	161.3	171.7	2.1	2.1
OTHER CHEMICALS	100.0	108.0	133.2	155.7	180.8	210.9	231.4	3.5	3.1
Consumption of Selected Fertilizer Chemicals									
Concentrated Superphosphate	100.0	95.2	106.8	114.6	125.1	146.1	134.0	1.1	1.2
Di Ammonium Phosphate	100.0	97.4	110.8	120.6	133.5	158.2	146.1	1.5	1.5
Nitrogen Solutions	100.0	107.5	130.4	150.2	177.4	227.0	219.5	3.2	3.0
Urea	100.0	117.9	158.8	201.2	259.2	359.2	363.4	5.5	4.7

Materials, CCDWC 2822, Synthetic Rubbers, CCDWC 2823, Synthetic Fibers, CCDWC 2891, Miscellaneous Chemical Products, and some other small volume, relatively high value chemical categories which predominantly move in foreign trade when traveling by water, nitrogen solutions for fertilizer use, and CCDWC 2818, Sulphuric Acid, for a wide variety of acid applications. The 'Other' chemical category contains a host of dissimilar chemicals as contents, and is by far the largest of the chemical categories. The contents of some of the CCDWC chemical categories are relatively well defined and straightforward in composition. However, idenitification of the contents of many of the CCDWC chemical categories, particularly CCDWC 2819, the largest component of 'Other' chemicals, and to a lesser extent CCDWC 2891, required extensive analysis and mapping of production and consumption data to waterborne traffic patterns to identify the CCDWC production and foreign trade indices. The contents of CCDWC 2819 can be categorized as a broad mix of organic and petrochemical intermediates although some inorganics are also present. The contents of CCDWC 2891 can be categorized as largely consisting of chlorine, ethylene glycol compounded as anti-freeze, tetraethyl lead in export traffic, and a broad mix of other miscellaneous chemicals. The growth in 'Other' chemicals largely reflects increased production of CCDWC 2819, occurring from increased use of chemicals in existing markets and penetration of new markets by chemical products, resulting in demands for increased production of a broad range of intermediates. Nitrogen fertilizer solutions are expected to increase in consumption due to ease of application, high nitrogen content, and cost competitiveness with alternative nitrogen sources for agricultural uses. Sulphuric acid (CCDWC 2818) production exhibits increases in almost all end uses, with losses occurring in pickling use for steel and iron production and titanium dioxide production for paint uses being noticeable exceptions. Sulphuric acid demands are forecast to grow at approximately 2.1% per year based upon a forecast by the United States Bureau of Mines of selected sulphur end use growth rates. Chemicals experiencing low growth include production of CCDWC 2810, Sodium Hydroxide, and consumption of DAP (Di-ammonium Phosphate) and concentrated superphosphate. Hydroxide and chlorine are coproducts of their most common production process, salt electrolysis. Chlorine is in higher demand than hydroxide, and is forecast to remain so. Since hydroxide assumes the position of a secondary coproduct, rather than the desired endproduct, hydroxide production rates are

constrained by the chlorine demand growth. Chlorine demands are primarily in chlorinated petrochemical products, and are not expected to exhibit as high a growth rate as some other petrochemical and plastic products which lowers the production growth of hydroxide. Phosphate fertilizers are expected to continue their historic trend of lower growth than that exhibited by nitrogenous fertilizers.

United States production of chemicals exceeds domestic demand, thus the United States is a net exporter of chemicals. This is expected to continue in the forecast period, although the decontrol of United States crude petroleum in 1982 will adversely impact the price competitiveness of some United States chemical exports for a period in the mid-1980's relative to world market prices, particularly as much of the United States chemical industry capital stock was designed in a period of cheap energy and raw material prices. Imports to the United States will drop sharply for industrial chemicals during 1980 but rise somewhat in 1985, while exports peak in 1980, drop to 1985, drop slightly further to 1990, and rise thereafter as both exports and imports return to long term growth paths in the 1990's. Fertilizer chemicals display opposing trends, with exports rising to 1985, and descending slowly thereafter, while imports exhibit sustained increases. The difference for the behavior of the two sectors of the chemical industry lies in the difference in driving forces for the foreign trade sector of the two industries, with United States controlled and decontrolled crude petroleum prices opposed to petroleum supplies priced continuously at OPEC levels for European, United States industrial chemical sector, while the fertilizer industry sector is more affected by the cost competitiveness of United States mined phosphate sources in world markets.

The Gulf Coast is expected to remain the primary concentration of chemical processing capacity, although regional centers in New Jersey, along the Ohio River and tributaries, near Chicago, in Michigan, along the South Atlantic Coast, in Puerto Rico, in the Pacific Northwest, and in California will remain important. As world petroleum prices rise, and coal based petrochemical feedstocks and coal use for fuel and power needs become increasingly economically attractive, a potential shift to the Ohio River and its tributaries, the Tennessee and Lower Upper

Mississippi rivers to secure access to coal without need for intermediate transportation becomes feasible. Regional activity shifts across scenarios reflect the changing national levels of activity. Differences in the national level of activity occur across macroeconomic alternatives, with industrial chemical domestic demands highest in 'TRENDLONG', and lowest in "BADENERGY', reflecting the impact of rising petroleum prices on the cost of petrochemical feedstocks and resultant decline in growth rates for industrial chemicals and chemical products as feedstock costs are passed through to final products, while domestic traffic for fertilizers is highest in 'BADENERGY' and lowest in "TRENDLONG', due to higher domestic and export grain market demands with concurrent changes in the level of fertilizers consumed. Fertilizer chemicals foreign trade was forecast to be similar across the three macroeconomic alternatives, and thus acts as a moderating influence on the shifts of industrial chemicals across alternatives. Industrial chemicals imports are highest for 'BADENERGY', while exports are highest for 'LARGERGOVT', while imports are lowest for 'LARGERGOVT' and exports are lowest for 'BADENERGY'. The increased penetration of both domestic and overseas markets by foreign producers with access to low cost raw materials (OPEC, Mexico, Canada) results in the foreign trade sector behavior for "BADENERGY", while in "LARGERGOVT' the reduced size of the domestic market by government crowding out forces United States producers to export aggressively and defend the United States market against penetration by imports to maintain sales and production levels. Since the magnitude of industrial chemicals exceeds that of fertilizers, chemical industry trends more nearly reflect the industrial chemical industry behavior.

(c) Key Industry Developments

Key industry developments include the model assumptions concerning the trajectory of OPEC pricing decisions which are adopted from the Energy Model (see Crude Petroleum). As crude petroleum prices rise substitution in the market place back to metal and/or agricultural products or at least lessened rates of market penetration for new applications of chemicals and chemical products becomes a possibility. The technology change to heavy gas/oil feedstocks from today's use of light petroleum cuts, naptha, and natural gas remains a problem in technology develop-

ment and in marketing to find applications for the differing mix of products derived from the alternative feedstocks. Forecast risks included the above items, along with the potential relocation to Midwestern, Northern Appalachian, and Southern Appalachian coal source locations of moderate amounts of chemical industry capacity, which is dependant upon the successful development of coal-based feedstock technology.

DISTRIBUTION SYSTEMS

The analysis of chemical and chemical products distribution and logistics systems included consideration of: (1) current and future trends in industry location by type of chemical processing industry, (2) factors affecting differential growth rates in regional industry capacity and locations of incremental capacity expansion, (3) modal comparative economics, relative costs, attributes and competitive advantages, (4) shifts in the source, nature and costs of the supply of chemical raw materials, especially petrochemical feedstocks, including the use of coal as direct or indirect feedstock sources, (5) locational impacts on industry capacity resulting from feedstock shifts, (6) shifts in demand for chemical end-products and the changes in demand for raw materials resulting from waterway and other modes capacity expansions, and finally, (7) impacts of government regulations affecting production and transportation of hazardous substances and environmental issues, and other relevant factors. These factors are discussed in detail in the following subsections.

(a) Role of Water Distribution

Key end markets for waterborne distribution of chemicals are in the movement of high volume, low value bulk intermediates and raw materials. Higher valued intermediates, small to medium volume shipments of raw materials and intermediates, and finished products tend to move by rail, or truck for short haul movements. Major modal competition includes pipeline for transportation of volatile gases (ammonia, ethylene, propylene) and rail for a wide range of chemicals in low to moderately high volume shipments. Major originating regions of waterborne chemicals include the Gulf Coast West (22,851,778 tons in

1977), Baton Rouge-Gulf, the Middle Atlantic Coast, the domestic Caribbean, the Ohio River, the California Coast, and the Gulf Coast East (1,321,328 tons in 1977). Major terminating areas include the Gulf Coast West (10,803,403 tons in 1977), the Middle Atlantic Coast, the Ohio River, Baton Rouge-Gulf, the Illinois, The Washington/Oregon Coast, the Tennessee, The Columbia/Snake Waterway, the Gulf Coast East, and the California Coast (1,234,065 tons in 1977). The Middle Atlantic Coast, Gulf Coast West and Baton Rouge-Gulf are the most important foreign trade segments.

(b) Factors Affecting Mode Choice

The single most important factor affecting modal choice for industrial chemical shipments is the volume of the shipments. Barge rates have historically been less than rail rates, but barge transportation is best suited for repetitive, large volume shipments rather than small or erratic shipments. The technology of pipeline is unsuitable except for pipelines dedicated to single or comingable products due to contamination problems between different product shipments. Rail and barge technology is mature, and is more affected by regulatory impacts concerning environmental and worker safety issues than by advances in the underlying transportation technology. Chemicals processing facilities are long-lived, capital intensive production facilities. Chemical production facilities, once sited and constructed, are inelastic in demand for transportation services, since the incremental costs of increased transportation charges are a small fraction of the total cost of production and annualized investment costs. Thus, chemical movements by water are more affected by long term changes in the cost of money, (which affects plant size and target market area, leading to changes in the level of transportation needs) than by short term changes in relative modal prices. Compounding this is the common-place need for dedicated equipment to avoid cleaning charges or contamination problems and the need for highly specialized and expensive equipment for marine transportation of chemicals. The effect of these is to reduce the short-term sensitivity of demand to marine transportation cost changes, once the initial decision has been made to ship by water.

(c) Distribution System Changes

Evolving trends in chemical distribution systems include ongoing relocations of industry capacity to water served locations, and attempts to shift terminalling activities by some major merchant chemical companies onto their customers rather than maintaining that role for themselves. Potential developments in chemical distribution for industrial chemicals include a potential shift of moderate amounts of capacity, with moderate impact on waterborne transportat n volumes during the late 1980's and throughout the 199 s, to plant locations along the Ohio, Tennesee, and Lower Upper Mississippi Rivers to take advantage of local coal deposits, either as a feedstock, or as an inexpensive power and fuel source. Impacts of increasingly stringent EPA, OSHA, and DOT reulations affecting hazardous substances production and transportation may shift relative modal costs in favor of modes other than barge, as well as reducing shipments of some substances by all modes. Direct imports of chemicals from Canada, Mexico and OPEC are likely to increase in the forecast period. Risks in the distribution systems developments include the successful development of a coal-based feedstock for chemicals and the impact this has on industry locational trends, and the impacts that government regulations will have on industry regional production levels and chemical product distribution. No major shifts are expected for the fertilizer industry, which is expected to remain in its currently predominant locations of the Gulf Coast East and Baton Rouge-Gulf.

WATERBORNE DEMAND PROJECTIONS

The Chemical Flow Model forecasts demands for waterborne chemical flows under macroeconomic alternatives, using an analytic framework that incorporated the relationships between the individual chemical products and the CCDWC codes into which they are classified, forecasts of the production, imports, exports and consumption of individual chemical products, regional trends in chemical industry processing capacity by type of chemical product accounting for factors affecting diffential growth rates across regions and incremental capacity expansion by region, developments in industry process technology,

changes in industry logistics and distribution systems, shifts in relative modal costs and other relevant factors.

(a) Projection Summary

By 2003, total waterborne chemicals traffic increases from 77,758,404 tons in 1977 to 149,952,756 tons, a 93% increase, reflecting a 2.6% per year growth rate. Domestic traffic increases at 3.3% per year from 1977 to 2003, from 46,093,250 tons to 105,869,827 tons in 2003, a 130% increase over 1977 traffic levels. Exports increase 25% to 2003, achieving a growth rate of .86% per year, changing from 20,892,.426 tons in 1977 to 25,968,809 tons in 2003, after rising to 30,892,246 tons in 1980 and 32,722,780 tons in 1985. Imports show upward trends from 1977, 10,856,955 tons, to 2003, 18,114,120 tons, a 67% increase over 1977 values and a 2% per year growth rate. The chemical traffic forecasts contain results for both industrial and fertilizer chemicals. Growth rates and factors affecting waterborne flows in the two end sectors of the chemical industry differ, and consequently, flow forecasts for the two groups were performed separately. Results from the traffic demand forecasts were combined and are presented together in this report in a single set of results.

(b) Major Market Shifts

Major market shifts in waterborne transportation demand for chemical categories generally follow the annual compound growth figures presented above in Table X-I and in the text above in the "Industry Outlook" section. Domestic movements of CCDWC 2819, a component of 'Other' chemicals, along with domestic movements of CCDWC 2811, CCDWC 2813, and CCDWC 2817 exhibit high growth. CCDWC 2811 and CCDWC 2819 also exhibit high growth rates for imports to 2003, but declines for 1980 from 1977 due to controlled United States crude petroleum prices. Exports of CCDWC 2811 show a high jump in 1980, reflecting controlled United States crude petroleum prices, but decline to near 1977 levels for 1985 to 2003. WCCS 2819, the primary foreign trade component of 'Other' chemicals, exhibits high growth rates for imports to 2003, along with substantial boosts in 1980 for exports of CCDWC 2819, CCDWC 2821, and CCDWC 2823, reflecting United States production costs having artificially low values due to

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controlled United States petroleum prices, with sharp drops for 1985 after decontrol in 1982. These trends are partially masked at the 'Other' chemical reporting commodity level by the inclusion of several chemical categories in the 'Other' reporting commodity category whose foreign trade flows do not reflect these trends and exhibit instead rather steady but slow increases over time for both domestic and foreign trade traffic, and result in 'Other' chemical traffic growth rates being less than that for CCDWC 2819. The apparent historically consistent misclassification of foreign trade flows for CCDWC 2810, CCDWC 2813, and CCDWC 2817 into CCDWC 2819, and the continuation of this into the forecast period removes the need to discuss foreign trade flows for these three chemical categories. Sulphuric acid foreign trade flows have historically been minimal, and are expected to continue so. Domestic sulphuric acid shipments grow at approximately 1% per year reflecting the impact of increased production of recovered sulphur at widely scattered locations in small to moderate tonnage volumes, which lessens the demand for bulk sulphuric acid waterborne transportation. Waterborne shipments of CCDWC 2810 reflect the same low growth as production of CCDWC 2810. Chemical fertilizers show strong growth in shipments to rivers serving the Corn Belt, while fertilizer exports grow rapidly to 1985, and then decrease steadily as phosphate rock production in Central Florida declines.

(c) Waterborne Flow Developments

Tables X-2, X-3, X-4, and X-5 present, respectively, domestic traffic (tons) originated and terminated by NWS Reporting Segment, domestic traffic (tons) by internal NWS Reporting Segment for traffic movements traversing all or part of an internal NWS Reporting Segment, domestic traffic (ton-miles) by internal NWS Reporting Segment for traffic movements traversing all or part of an internal NWS Reporting Segment, and foreign trade traffic (tons) exported and imported by NWS Reporting Segment.

Domestic Chemical traffic on the waterways extends to every NWS Reporting Segment. Some segments, however, are decidely more major in tonnage flows than other segments. The more important traffic segments were mentioned above for domestic originations, domestic terminations, and

foreign trade for 1977 traffic movements above in the "Role of Water Transportation" section. These segments are expected to remain major in tonnage, although the Ohio, Baton Rouge-Gulf, and Gulf Coast West exhibit the largest increases in originated and terminated tonnages to 2003. Domestic chemical traffic is expected to generally display sustained increases in traffic over both the 1977-1990 and 1990-2003 periods for both originating and terminating flows across individual NWS Reporting Segments. Exceptions to this include the Hawaii and domestic Pacific and California Coast segments, where minor declines in tonnage from 1977 to 1980 are evidenced due to environmental constraints. Growth rates are generally in the range of 2% per year to 4% per year for originations and terminations for 1977-1990 and 1990-2003. The growth on the Ohio River of 7.2% per year for 1990-2003 for originations reflects the impact of industry relocation for access to coal. Shifts in domestic traffic include substantial increases in originated and terminated traffic on the Ohio River and tributaries, the Tennessee, and Lower Upper Mississippi Rivers to gain access to coal for fuel and power uses and raw material uses as feedstocks, as siting of plants in these locations increase, particularly through the 1985-2000 period. Fertilizers terminations are prominent on three rivers, the Ohio, the Illinois, and the Upper Mississippi, at 1,104,000, 1,169,000, and 1,314,000 tons in 1977 respectively, growing to 2,887,000, 3,547,000, and 3,519,000 tons in 2003. Fertilizer originations are promiment at Baton Rouge-Gulf, Gulf Coast West, and Gulf Coast East, at 3,676,000, 786,000, and 704,000 tons in 1977, rising to 7,9992,000, 1,263,000 and 1,217,000 tons respectively in 2003.

Tonnage and ton-mile changes for internal segments generally reflect similar changes across the two traffic concepts. The changes are generally similar to the changes for originated and terminated domestic traffic by segment, and are generally between the value of the changes for originated and terminated traffic for each segment. Exceptions to this include the Lower Upper Mississippi, where traffic destined for the Illinois and Upper Mississippi Rivers boosts Lower Upper Mississippi tonnage and ton-mile changes above the originated and terminated tonnage changes for the Lower Upper Mississippi.

Table X-2

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY Chemicals
ALTERNATIVE Trendlong2003A

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Shipped	372	434	540	639	768	908	996	4.3	3.5
	Received	1,900	2,124	2,693	3,169	3,751	4,870	4,814	4.0	3.3
Lower Upper Mississippi	Shipped	508	556	675	781	985	1,382	1,434	3.4	4.8
	Received	873	936	1,139	1,320	1,542	1,845	1,961	3.2	3.1
Lower Mississippi	Shipped	792	870	1,054	1,221	1,432	1,774	1,809	3.4	3.1
	Received	971	1,037	1,238	1,437	1,676	1,941	2,070	3.1	2.8
Baton Rouge to Gulf	Shipped	13,099	14,213	17,443	20,193	23,199	27,232	28,999	3.4	2.8
	Received	4,338	4,705	5,742	6,669	7,655	8,937	9,787	3.4	3.0
Illinois River	Shipped	418	460	568	674	798	955	1,051	3.7	3.5
	Received	3,767	4,353	5,390	6,296	7,474	9,035	9,670	4.0	3.4
Missouri River	Shipped	135	153	189	221	263	340	338	3.9	3.3
	Received	445	448	476	504	539	583	598	1.0	1.2
Ohio River	Shipped	1,916	2,063	2,510	3,126	4,539	6,906	7,739	3.8	7.2
	Received	6,904	7,403	9,176	10,935	13,434	17,047	18,544	3.6	4.1
Tennessee River	Shipped	580	617	731	880	1,153	1,451	1,551	3.3	4.5
	Received	2,038	2,195	2,683	3,149	3,670	4,256	4,666	3.4	3.1
Arkansas River	Shipped	80	85	99	112	125	140	151	2.6	2.3
	Received	516	561	688	792	909	1,082	1,108	3.4	2.6
Gulf Coast West	Shipped	17,780	19,397	23,594	27,609	31,808	36,653	40,393	3.4	3.0
	Received	10,011	10,931	13,336	15,711	18,312	21,139	23,427	3.5	3.1
Gulf Coast East	Shipped	1,195	1,237	1,490	1,709	1,947	2,240	2,325	2.8	2.4
	Received	1,559	1,611	1,818	2,036	2,241	2,507	2,677	2.1	2.1
Warrior River System	Shipped	416	446	535	615	700	798	873	3.1	2.7
	Received	760	787	912	1,019	1,136	1,319	1,431	2.3	2.6
South Atlantic Coast	Shipped	1,028	1,069	1,174	1,277	1,371	1,485	1,572	1.7	1.6
	Received	2,160	2,301	2,653	3,008	3,390	3,851	4,204	2.6	2.6
Middle Atlantic Coast	Shipped	2,740	2,849	3,271	3,711	4,255	4,883	5,361	2.4	2.9
	Received	5,544	5,958	7,076	8,155	9,286	10,711	11,803	3.0	2.9

Table X-2 (continued)

SEGMENT	IN/OUT	1977	1980	1985	YEAR? 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Shipped	26	27	31	35	38	43	46	2.3	2.2
	Received	663	718	866	1,007	1,160	1,337	1,471	3.3	3.0
Great Lakes and Seaway	Shipped	629	671	799	944	1,130	1,339	1,509	3.2	3.7
	Received	498	532	[illegible]	749	906	[illegible]	1,230	3.2	3.9
Washington/Oregon Coast	Shipped	786	829	947	1,055	1,182	1,364	1,486	2.3	2.7
	Received	526	557	632	703	788	911	905	2.3	2.7
Columbia-Snake Willamette River	Shipped	226	238	276	310	345	385	414	2.4	2.3
	Received	697	739	870	985	1,106	1,235	1,333	2.7	2.4
California Coast	Shipped	371	344	414	480	559	648	717	2.0	3.1
	Received	1,049	1,127	1,356	1,561	1,789	2,093	2,279	3.1	3.0
Alaska	Shipped	314	330	381	427	479	544	573	2.4	2.3
	Received	124	131	153	175	201	233	256	2.7	3.0
Hawaii and Pacific Territories	Shipped	27	14	18	21	25	30	33	2.1	3.9
	Received	212	155	187	216	254	297	329	0.1	3.3
Domestic Caribbean	Shipped	2,654	2,923	3,633	[illegible]	5,030	5,845	6,498	3.8	3.2
	Received	538	521	635	754	913	1,090	1,227	2.6	3.8
Total	Shipped	46,093	49,831	60,370	70,348	82,131	97,425	105,870	3.3	3.2
	Received	46,093	49,831	60,370	70,348	82,131	97,425	105,870	3.3	3.2

a - less than 500 tons

Table X-3

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL, AND THROUGH

COMMODITY: Chemicals
ALTERNATIVE: Trendlong2003A

				YEARS				% GROWTH	
SEGMENT	1977	1980	1985	1990	1995	2000	2003	77-90	90-03
Upper Mississippi	2,080	2,327	2,953	3,477	4,119	5,332	5,[illegible]	4.0	3.3
Lower Upper Mississippi	6,861	7,684	9,459	10,994	13,003	16,04[illegible]	16,8[illegible]	[illegible]	3.3
Lower Mississippi	14,878	16,269	20,052	23,409	27,317	32,619	34,782	3.5	[illegible]
Baton Rouge to Gulf	21,080	22,935	28,099	32,689	37,810	44,564	4[illegible],956	3.4	3.[illegible]
Illinois River	4,066	4,677	5,787	5,768	8,033	9,693	10,406	4.[illegible]	3.4
Missouri River	519	560	622	619	755	871	876	1.8	2.0
Ohio River	9,603	10,323	12,745	15,186	18,723	23,770	25,957	3.6	4.2
Tennessee River	2,484	2,672	3,251	3,842	4,601	5,450	5,942	3.4	3.1
Arkansas River	595	646	787	903	1,034	1,223	1,259	3.3	2.6
Gulf Coast West	21,058	22,962	27,920	32,730	37,895	43,874	48,448	3.5	3.1
Gulf Coast East	3,619	3,782	4,4.9	4,987	5,586	6,368	6,770	2.5	2.4
Warrior River System	1,140	1,194	1,404	1,586	1,782	2,055	2,237	2.6	2.7
Great Lakes	700	749	894	1,058	1,265	1,499	1,688	3.2	3.7

a = less than 500 tons

Table X-4

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY: [illegible]
ALTERNATIVE: [illegible]

SEGMENT	197	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	788	879	1,118	1,317	1,558	2,016	2,000	4.0	3.3
Lower Upper Mississippi	1,389	1,558	1,921	2,233	2,639	3,245	3,405	3.7	3.3
Lower Mississippi	9,637	10,544	13,014	15,198	17,730	21,169	22,603	3.6	3.1
Baton Rouge to Gulf	2,262	2,458	3,006	3,489	4,030	4,746	5,098	3.4	3.0
Illinois River	937	1,078	1,334	1,559	1,851	2,232	2,396	4.0	3.4
Missouri River	283	295	328	359	400	463	466	1.9	2.0
Ohio River	3,995	4,313	5,348	6,374	7,822	9,919	10,849	3.7	4.2
Tennessee River	578	624	765	907	1,084	1,295	1,415	3.5	3.5
Arkansas River	112	121	148	170	194	230	236	3.3	2.6
Gulf Coast West	3,618	3,932	4,751	5,548	6,422	7,463	8,221	3.3	[illegible]
Gulf Coast East	458	474	557	629	707	811	868	2.5	2.5
Warrior River System	143	148	173	195	219	253	275	2.4	2.7
Great Lakes	207	220	259	299	348	401	447	2.9	3.1
Total	24,408	26,643	32,721	38,277	45,004	54,244	58,279	3.5	3.3

a = less than 500,000 ton miles

Table X-5

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY Chemicals
ALTERNATIVE Trend1ong2003A

SEGMENT	EXP/IMP	1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	3,410	5,117	5,479	4,721	4,508	4,254	4,102	2.5	-1.1
	Imports	1,301	1,202	1,294	1,331	1,654	1,906	2,076	0.5	3.1
Illinois River	Exports	8	12	12	11	12	12	12	2.4	0.3
	Imports	85	79	86	94	112	130	142	0.8	3.2
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	7,208	10,419	8,934	8,352	8,360	8,306	8,284	1.1	0.1
	Imports	1,222	1,083	1,201	1,322	1,427	1,712	1,905	0.6	2.8
Gulf Coast East	Exports	4,032	6,438	9,448	7,252	6,315	5,379	4,818	4.6	3.1
	Imports	736	1,595	1,620	1,666	1,817	1,961	2,058	6.5	1.6
Warrior River System	Exports	45	65	54	51	54	56	57	1.1	0.8
	Imports	10	10	10	11	13	14	15	1.3	2.4
South Atlantic Coast	Exports	1,021	1,610	2,009	1,744	1,691	1,615	1,571	4.2	-0.8
	Imports	927	886	910	963	1,053	1,141	1,200	0.3	1.7
Middle Atlantic Coast	Exports	1,809	2,615	2,708	2,792	2,954	3,012	3,050	3.4	0.7
	Imports	2,772	2,545	2,782	3,037	3,262	3,790	4,174	0.7	2.5

Table X-5 (continued)

SEGMENT	EXP/IMP	YEARS 1977	1980	1985	1990	1995	2000	2003	% GROWTH 77 90	90 03
North Atlantic Coast	Exports	20	13	35	37	40	41	42	4.7	0.3
	Imports	113	98	109	120	151	179	199	0.6	4.0
Great Lakes and Seaway	Exports	78	109	103	104	108	110	112	2.2	0.5
	Imports	253	241	252	262	292	319	338	0.3	2.0
Washington/Oregon Coast	Exports	105	138	134	135	142	153	160	1.9	1.3
	Imports	1,427	1,235	1,372	1,512	1,946	2,350	2,635	0.4	4.4
Columbia Snake Willamette River	Exports	41	58	50	47	47	47	47	1.0	0.1
	Imports	1,371	1,189	1,312	1,438	1,840	2,213	2,475	0.4	4.3
California Coast	Exports	1,713	2,366	2,224	2,183	2,242	2,254	2,263	1.9	0.3
	Imports	476	461	484	508	563	617	655	0.5	2.0
Alaska	Exports	325	369	341	331	331	331	331	0.1	0.0
	Imports	33	40	44	48	56	65	70	2.9	3.0
Hawaii and Pacific Territories	Exports	1	1	1	1	1	1	1	3.5	0.5
	Imports	58	56	57	59	62	65	67	0.1	1.1
Domestic Caribbean	Exports	992	1,543	1,[illegible]	1,108	1,118	1,119	1,121	0.9	0.1
	Imports	76	73	76	79	88	96	102	0.3	2.0
Total	Exports	20,808	30,892	32,723	28,868	27,923	26,031	25,969	2.6	0.8
	Imports	10,857	10,793	11,603	12,510	14,336	16,559	18,114	1.1	2.9

a = less than 500 tons

Foreign trade traffic in chemicals is prevalent for both exports and imports. The United States is a net exporter of chemicals and is forecast to remain so during the forecast period, although the excess of exports over imports will decline. Segments exporting major tonnages of chemicals include the Gulf Coast West, Baton Rouge-Gulf, Middle Atlantic Coast, California Coast, and domestic Caribbean. Segments importing major tonnages of chemicals include the Middle Atlantic Coast, the Washington-Oregon Coast, the Columbia-Snake Waterway, Gulf Coast West, and Baton Rouge-Gulf. Fertilizer foreign trade movements are important at Baton Rouge-Gulf, Gulf Coast East, and Gulf Coast West.

Waterborne chemical flows will exhibit some shifts over the forecast period. In particular, a moderate shift from Gulf Coast locations, with moderate impact on shipping volumes, of industry capacity from the Gulf coast to the Ohio, Tennessee, and Lower Upper Mississippi River segments is expected to occur, due to coal based chemical facilities. Substantial volumes of coal based chemical facilities are expected to be built along the Gulf Coast and the lower reaches of the Mississippi River. The latter plants will not act to alter flow patterns of chemicals, while the former representing a shift in industry location, will act to shift flow patterns. Terminations, while affected to an extent, are not affected as much as originations due to the downstream derivative processing plants substantially remaining in their current locations. Other major displacements in flows patterns are not expected. Gulf Coast locations are expected to remain prominent in industry capacity and plant sites, as environmental constraints reduce new facility developments on the West and East Coasts.

Flow forecast risks include the impact of ever increasing OPEC prices on crude petroleum, the effects this has on demand for petroleum based chemicals and indirectly on demand for transportation of chemicals, the successful development of a coal based chemical feedstock technology, and the impacts this has on industry location of new capacity.

XI - PETROLEUM AND COAL PRODUCTS

INDUSTRY OUTLOOK

The Petroleum and Coal Products Industry Model used for forecasting petroleum product demands and supplies is a subset of the Energy Model (see Crude Petroleum) which is a comprehensive modeling system that forecasts prices, production, imports and exports, supplies, and demands for several alternative energy sources including petroleum (crude and refined products), natural gas, coal, nuclear, solar, hydro, exotic, etc. for use in several end markets (commercial, residential, utility, industrial, and transportation) for both fuel and power uses and raw materials uses. The model's level of regional detail extends down to 13 separate Energy Demand Regions for which regional demands of energy by source and end-use are reported. The petroleum products covered in the model are gasoline, jet fuels kerosine, distillate fuels, residual fuels, and "other" petroleum products, for which petroleum coke, still gas, asphalt and road oil, special napthas, liquified gases, lubes and waxes, and petrochemical feedstocks are forecasted and reported separately. For the purposes of this study jet fuels and kerosine were combined for reporting purposes as were the components of the "other" petroleum products listed above, each group forming a single analysis commodity group. The model considers regional economic activity, employment levels, transportation, industrial, and urban infrastructures, other regional economic variables, and national factors in forecasting regional supplies and demands for energy, including petroleum products.

(a) Industry Background

The petroleum product industry refines crude petroleum into refined petroleum products, principally gasoline, jet fuel and kerosine, distillate fuels, residual fuels, and "other" petroleum products, and oversees the distribution and marketing of these products. In 1977 the industry consumed 14.79 million barrels per day (mmbd) of crude petroleum; produced 7.4 mmbd and imported .2 mmbd of gasoline; produced 3.1 mmbd and imported .2 mmbd of distillate fuels; and produced 1.6 mmbd and imported 1.3 mmbd of residual fuels, while other products (jet fuels and kerosine, other petroleum products) were produced in

considerably less volume. Technology employed in petroleum refining is experiencing evolutionary rather than revolutionary changes. Process technology suitable for cracking of heavy sour crudes is becoming more commonly used, particularly on the West Coast and other locations refining heavy Californian or Alaskan crudes or imports of foreign heavy, sour crudes. Imports of petroleum products are present on all coasts, but predominate on the East Coast, where the North Atlantic Coast, Middle Atlantic Coast, and South Atlantic Coast all receive substantial imports of products, particularly of residual fuels. Exports of petroleum products other than lubes and waxes are either minor in magnitude or considerably less than imports. Demands for products have grown at different rates, but historically demands for all products have exhibited upward trends through the 1960s and 1970s.

(b) National and Regional Forecasts

Table XI-1 presents consumption figures for a variety of petroleum products. Total energy demand is forecast to grow at an average annual compound rate of 1.89% for the 1977-2003 period, while aggregate petroleum product consumption (Btu basis - energy content) grows at a rate of .45% for fuel and power uses, 3.5% for raw material uses, and .89% for all uses combined. The cause for the low growth rate for fuel and power uses of petroleum products relative to total energy demand reflects the increasing relative cost of petroleum products compared to alternative energy sources, while the high growth rate for raw material uses reflects high demand for petrochemicals and construction activity uses of asphalt and related petroleum products. National gasoline demand declines from 1977 to 1990 at -.94% per year (average annual compound growth rate) after which it increases at .52% per year to 2003. Gasoline trends show mixed results at the regional level, with snowbelt states exhibiting the highest declines, and sunbelt regions exhibiting the highest growth. Shifts in gasoline demand reflect its rising real price, a more fuel efficient motor vehicle stock with increased use of diesel (distillate) fuel powered vehicles, and increasing population. Jet fuel and kerosine exhibit growth at 2.25% per year for 1977-1990, lessening to 1.09% per year from 1990 to 2003. The growth reflects increased use of air transportation with regional growth highest for highly urbanized regions. Distillate fuel demands grow at 2.81%

Table XI-1

National and Regional Petroleum Products
Demands

Scenario: @trendlong2003A
Millions of Barrels per Year
Source: Energy Model

	1977	1980	1985	1990	1995	2000	2003	% Compound Annual Growth 1977 to 1990	1990 TO 2003
National Demands by Petroleum Product									
'GASOLINES'	2,690.0	2,717.9	2,462.9	2,317.8	2,369.2	2,440.7	2,479.9	1.1	0.5
'JET FUEL & KEROSINE'	443.2	472.9	532.0	594.4	633.1	666.1	683.6	2.3	1.1
'DISTILLATE FUELS'	1,210.9	1,251.1	1,474.7	1,740.8	1,889.6	1,982.1	2,026.2	2.8	1.2
'RESIDUAL FUELS'	1,060.3	938.8	909.2	928.2	832.5	762.2	724.2	1.0	-1.8
'OTHER PETROLEUM PRODUCTS'	947.4	1,031.6	1,163.0	1,339.3	1,513.1	1,737.5	[illegible]	2.7	2.7
'TOTAL PETROLEUM PRODUCTS'	6,351.8	6,412.4	6,541.7	6,920.7	7,237.5	7,588.7	7,828.8	0.7	1.0
Regional Demands for Total Petroleum and Coal Products									
New England	439.7	454.3	454.5	451.3	444.3	433.3	426.7	0.2	-0.4
Middle Atlantic	1,045.5	1,037.3	977.7	964.9	930.9	[illegible]	881.2	0.6	0.7
South Atlantic	957.7	930.3	926.4	962.5	985.9	1,014.0	1,071.3	0.0	0.8
East North Central	370.8	982.4	[illegible]	958.1	997.6	1,012.7	1,052.8	0.1	0.7
West North Central	421.4	439.8	456.2	475.7	511.8	531.8	557.4	0.9	1.2
East South Central #1	177.5	188.3	197.0	214.8	239.4	265.2	281.3	1.5	2.1
West South Central #1	72.9	78.0	81.5	87.7	95.9	103.9	[illegible]	1.4	1.6
East South Central #2	170.9	172.0	171.7	180.3	191.5	202.5	208.4	0.4	1.1
West South Central #2	968.5	1,039.6	1,163.7	1,348.7	1,502.1	1,691.8	1,829.0	2.5	2.4
Mountain #1	36.3	38.8	37.6	37.9	38.1	38.2	37.8	0.3	0.0
Mountain #2	170.3	182.6	190.2	202.8	217.7	230.9	237.9	1.4	1.2
Mountain #3	87.7	101.7	[illegible]	108.1	131.1	151.2	167.9	1.6	3.4
Pacific	832.6	767.4	839.0	927.7	951.2	961.4	968.6	0.8	0.3
Total U S	6,351.8	6,412.4	6,541.7	6,920.7	7,237.5	7,588.7	7,828.8	0.7	1.0

per year for 1977-1990, and at 1.2% per year for 1990-2003. These high growth rates reflect increased use of diesel powered trucks and cars, and continued expansion of demands in the commercial, light industry, and residential sectors. Regional trends are mixed, with northeastern states showing the least growth, and sunbelt regions exhibiting the highest. The industrial midwest shows moderately high growth. Residual fuels decline at -1.2% per year for 1977-1990, and at -1.8% for 1990-2003.

The decline results from legislative and regulatory impacts affecting fuel use choices for large industrial and electric utility users of residual fuels, the primary users of resid. As the existing capital stock of resid-fired boilers rolls over, replacement by resid-fired boilers is prohibited, forcing a downward trend in demands for residual fuels. Residual fuels are mostly used where waterborne delivery is feasible, along the East, Gulf and West Coasts, and along rivers and lakes in the industrial midwest. Regional trends are mixed, with the Gulf Coast showing an increase, while all other regions exhibit decreases, with the East Coast and the industrial midwest having the greatest declines in demand. Imports of residual fuels, which are the largest component of total petroleum product imports, exhibit similar declines. "Other" petroleum products exhibit increases in demand for 1977-1990 of 2.7% per year and 2.75% per year for 1990-2003. The increased use of raw material uses of petroleum products, largely contained within this category, accounts for the demand growth. Regional trends are mixed, with the greatest growth occurring along the Gulf Coast resulting from petrochemical complexes. The most important shifts in share between products occurs in the shift between residual fuels and distillate fuels, resulting from the continued growth of distillate for commerical, residential, and transportation uses while the heavy industry and utility uses of residual fuels, the primary end-uses of resid, diminish as substitution by coal, natural gas and electricity from coal, nuclear and hydro take place. Gasoline also loses share, resulting from its declining to weakly increasing growth rates, while jet fuels, kerosine and other petroleum products all gain share as continued growth in demand occurs. Demand and supply changes exist across the macroeconomic alternatives, with 'BADENERGY' displaying flat demand for total petroleum products use, opposed to the .85% per year

growth exhibited in 'TRENDLONG', while 'LARGERGOVT' displays about two-thirds of the growth associated with 'TRENDLONG'. The mixed trends for individual petroleum products exhibited in 'TRENDLONG' are repeated for the other two macroeconomic alternatives, but reflect the lower growth rates implied by the changes in total petroleum product demand. Changes in regional levels in the macroeconomic alternatives reflect the differing level of demand and supplies present in the national forecasts.

(c) Key Industry Developments

The most important factor affecting demands for petroleum products (and also for crude petroleum) is the price trajectory pursued by OPEC. With United States decontrol of crude to world market levels scheduled to be accomplished by 1982, and world prices of crude effectively set by OPEC, increased use of alternative energy sources will be achieved. The rate of the shift depends largely upon the crude prices set by OPEC. 'TRENDLONG' alternative assumes a 3.8% annual increase in the real price of crude petroleum, while 'BADENERGY' assumes a 4.9% increase in price. Deviations from these price increase forecasts will alter the rates of development of coal, hydro, nuclear, oil shale and coal based synfuels development programs, while conservation and price induced demand reductions will also assume different values. Through 1982 prices for petroleum products will grow at a considerably faster rate than prices for OPEC crude, as domestic oil moves from controlled levels to parity with world oil. After 1982 domestic petroleum product prices are based wholly on crude priced at world levels. However, the non-crude cost components of refining will not grow at world crude price growth rates, and thereafter product prices will grow at slightly lower than world crude rates. Refinery technology will continue to undergo evolutionary shifts, particularly in the ability to process heavy, sour crudes into low sulphur fuel oils and gasoline. Massive domestic crude petroleum discoveries, nuclear moratoriums, abandonment of coal resources as an energy source, or other dramatic shifts in energy policy are not included in the forecast assumptions.

DISTRIBUTION SYSTEMS

The analysis of petroleum product distribution and logistics systems included consideration of current and future trends in refinery location, barge/pipeline/tanker comparative economics and relative costs, modal attributes and competitive advantage, shifts in the levels of supply and demand of petroleum products at both regional and national levels both across aggregated petroleum products and within individual petroleum products, waterway, port facility, and pipeline system expansions, impacts of government regulations affecting production and transportation of hazardous substances and environmental issues, and other relevant factors.

(a) Role of Water Transportation

The role of water transportation for petroleum products is to provide transportation of products to or from facilities and locations not adequately served by economical pipeline connections. Waterborne shipments originate from most waterside refineries, and from ex-pipe water-served terminals and waterfront distribution terminals, moving to waterfront distribution terminals and to large waterfront consumers of products. Rail and truck are complementary, rather than competing carriers. Pipeline transportation is not as dominant in product distribution as in crude distribution, due to the greater number of receiving locations (terminals and consumers) and smaller flows to each location compared to crude flowing in large quantities to refineries. Barge is more suited for the final delivery step, due to pipeline's need for large concentrated flows to be economical. Barge also serves as a peak load mode when pipeline systems are at capacity or not present. In 1977 pipeline carried 36% of product tonnage, while water carried 25% of product tonnage and pipeline carried 41% of product ton-miles, while water carried 51% of product ton-miles.

(b) Factors Affecting Modal Choice

Factors affecting modal choice include the magnitude and variability of demand at a location. Barge rates are generally 1.2 to 3 times point-to-point pipe rates, for

those moves economical to accomplish by pipe, but barge can serve all points along an entire coast or river, while pipe only serves specific locations, and once installed, exhibits little flexibility in supplying alternative locations. Barge can also easily supply varying quantities, while pipeline flows are best suited for large steady flows. Barges' higher operating costs are partially offset by lower initial investments costs. In areas where water competition is possible, product pipelines tend to serve as the long haul shipment mode for pipeable products and also tend to be large (Colonial, Explorer, Texas Eastern), while pipelines serving regions not accessible by water are generally smaller in size and assume more of the local distribution role of barge operations by incorporating more frequent stublines, terminals, and smaller diameters. This discussion is not applicable to nonpipeable products, such as residual fuels and most components of other petroleum products, which tend to move in large volume by water for short, medium, and long distances and will continue to do so. These nonpipeable flows distort the aggregate statistics reported above for mode share, particularly the ratio of ton-miles to tons (average length of haul). The technology associated with barge, pipeline and tanker transportation is mature, and is more affected by environmental issues than by advances in the underlying technology. Current shifts to double hulled tank barges for use on internal waterways from single hulled craft will substantially add to the cost of barge construction costs.

(c) Distribution System Changes

Evolving changes in the petroleum product distribution system include the current regulatory action to require double hulled barges at substantial increases in construction costs. Expected changes include the completion of the Colonial Pipeline expansion with transmission capacity to Baltimore increased from .8 mmbd to 2.5 mmbd, This will reduce Gulf Coast to East Coast flows, as it becomes possible to ship large volumes by pipe to Baltimore at a cost less than that of coastal waterborne flows. Baltimore might become a substantial ex-pipe barge loading center, shipping to points on the East Coast, or Colonial might expand north to Philidelphia or even to northern New Jersey with increased transmission capacity. Risks associated with the forecast include the level of the general

increase in pipeline transmission capacity, and the efforts of pipeline transmission companies, frequently financially related to major oil companies, to secure traffic for their systems in the face of declining or flat pipeable petroleum product demands, particularly gasoline.

WATERBORNE DEMAND PROJECTIONS

The Petroleum Products Flow Model forecasts demand for waterborne petroleum product flows under macroeconomic alternatives for individual petroleum products, using as inputs current pipeline and waterborne product flows, forecasts of regional and national production and consumption, imports and exports by product from the Energy Model, and shifts in industry logistics and distribution systems from an analysis of industry logistics and distribution system changes, including waterway, port facility, and pipeline expansions affecting both crude and product movements, shifts in relative modal costs and other relevant factors.

(a) Projection Summary

By 2003 total petroleum product waterborne traffic declines about 2% from 1977 levels, reflecting declining imports and exports and relatively flat domestic traffic. The traffic patterns are affected by declining (29% loss) residual domestic traffic, declining (36% loss) residual import traffic, increased domestic traffic (31% gain) for distillates, increases (35% gain) for domestic jet fuel and kerosine traffic, increases (83% gain) for other petroleum products domestic traffic, and declining (18% loss) domestic gasoline movements from 1977 levels in 2003. Distillate, jet fuel and kerosine traffic increases fall short of increases in demand, due to pipeline competition, while gasoline traffic losses exceed those of gasoline consumption declines, again due to pipeline competition. Residual fuels remain the largest single petroleum product carried on the waterways in terms of tons, despite its 30% loss in traffic tonnage resulting from decreases in demands.

(b) Major Market Shifts

The largest market shift is the large reduction in share of shipments for residual fuels, despite it retaining the largest shipment volume of petroleum products, with gasoline also losing significant share, again due to reduction in demand, but in this case augmented by pipeline competition for gasoline shipments. Distillates, jet fuels, kerosine, and other petroleum products all increase share. Table XI-2 below summarizes the shifts in tonnage and share for petroleum products in 1977, 1990, and 2003.

(c) Waterborne Flows Developments

Tables XI-3, XI-4, XI-5, and XI-6 present, respectively, domestic traffic (tons) shipped and received by NWS Reporting Segment, domestic traffic (tons) by NWS Reporting Segment for movements traversing all or part of an NWS Reporting Segment, domestic traffic (ton-miles) by NWS Reporting Segment for movements traversing all or part of an NWS Reporting Segment, and foreign trade traffic (tons) exported and imported by NWS Reporting Segment. Petroleum product movements are predominantly in domestic traffic, although imports are prominent at the East Coast, particularly the Middle Atlantic Coast. Domestic flow patterns change over the forecast period reflecting changes in regional and national aggregate and individual petroleum product demand and supply, and pipeline competition for pipeable commodities in the form of both increases in pipeline capacity and attempts by pipeline operators to maintain flows at capacity in the face of slow growth or declining demand for the transportation of pipeable products.

Although product flows are present in all of the NWS Reporting Segments some segments are decidedly more major in importance than others. Among these are the Baton Rouge-Gulf, Ohio River, Gulf Coast West, Gulf Coast East, South Atlantic, Middle Atlantic, North Atlantic, California Coast, and domestic Caribbean segments. Traffic exhibits mixed trends across segments and time periods, reflecting the changing demand and supply levels by region, and the changing mix of products within regions. River segments along the mainstem Mississippi, Illinois, Ohio, Missouri, Warrior, and Tennessee Rivers exhibit both

Table XI-2
CHANGES IN DOMESTIC WATERBORNE PETROLEUM PRODUCT
TRAFFIC SHARE

TRENDLONG SCENARIO

	1977		1990		2003	
	Tons	Share (%)	Tons	Share (%)	Tons	Share (%)
Gasoline	94,880,064	26.0	75,787,400	20.6	77,693,365	21.2
Jet Fuel and Kerosine	18,121,914	5.0	21,486,454	5.8	24,501,808	6.7
Distillate Fuels	89,600,580	24.6	109,737,987	29.9	117,819,931	32.2
Residual Fuels	134,010,521	36.8	121,971,895	33.2	95,482,228	26.1
"Other"	27,738,512	7.6	38,179,716	10.4	50,648,039	13.8
Total	364,417,591	100.0	367,163,452	100.0	366,145,372	100.0

Table XI-3

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY Petroleum and Coal Products
ALTERNATIVE Trendlong2003A

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Shipped	1,399	1,463	1,549	1,664	1,812	1,938	2,008	1.3	1.5
	Received	3,035	3,121	3,218	3,373	3,577	3,750	3,836	0.8	1.0
Lower Upper Mississippi	Shipped	6,334	6,413	6,478	6,725	7,018	7,304	7,454	0.5	0.8
	Received	2,891	2,936	2,908	2,944	3,079	3,217	3,295	0.1	0.9
Lower Mississippi	Shipped	2,006	2,033	2,146	2,331	2,491	2,610	2,654	1.2	1.0
	Received	8,807	8,704	8,876	9,125	9,571	9,790	9,878	0.4	0.4
Baton Rouge to Gulf	Shipped	43,713	43,517	42,151	46,168	46,831	47,793	48,432	0.4	0.4
	Received	19,215	19,391	21,425	25,261	25,589	26,227	26,804	2.1	0.5
Illinois River	Shipped	3,499	3,521	3,554	3,733	3,915	4,087	4,200	0.5	0.9
	Received	6,551	6,551	6,492	6,720	7,071	7,360	7,575	0.2	0.9
Missouri River	Shipped	168	183	197	216	235	256	271	2.0	1.7
	Received	268	290	311	338	366	398	419	1.8	1.7
Ohio River	Shipped	9,805	9,771	9,670	9,897	10,171	10,424	10,533	0.1	0.5
	Received	19,035	19,034	19,001	19,823	20,110	21,411	21,833	0.3	0.7
Tennessee River	Shipped	184	187	198	217	224	232	234	1.1	0.7
	Received	1,941	1,922	2,108	2,365	2,586	2,820	2,968	1.5	1.8
Arkansas River	Shipped	1,084	1,070	964	886	851	832	823	1.5	0.6
	Received	1,422	1,449	1,401	1,394	1,350	1,322	1,3[illegible]	0.2	0.5
Gulf Coast West	Shipped	81,572	81,148	72,542	77,897	79,119	81,155	82,594	0.4	0.5
	Received	21,623	22,076	24,316	28,050	29,134	30,517	31,531	2.0	0.9
Gulf Coast East	Shipped	12,002	11,763	11,508	11,859	11,848	12,093	12,286	0.1	0.3
	Received	19,146	18,571	18,057	18,365	18,257	18,547	18,790	0.3	0.2
Warrior River System	Shipped	2,602	2,674	2,908	3,258	3,417	3,604	3,727	1.7	1.0
	Received	3,120	3,134	3,134	3,298	3,439	3,612	3,718	0.4	0.9
South Atlantic Coast	Shipped	7,094	6,333	5,649	5,375	4,367	4,019	4,056	-2.1	-2.1
	Received	31,994	31,044	30,190	30,618	30,251	30,691	31,142	-0.3	0.1
Middle Atlantic Coast	Shipped	112,406	110,500	107,771	107,586	103,448	99,605	97,122	0.3	0.8
	Received	129,100	127,246	116,497	118,622	115,145	111,874	109,805	0.6	0.6

Table XI-3 (continued)

SEGMENT	IN/OUT	YEARS 1977	1980	1985	1990	1995	2000	2003	% GROWTH 77 90	90 03
North Atlantic Coast	Shipped	8,500	8,819	8,983	8,971	8,728	8,362	8,133	0.4	0.8
	Received	48,247	48,963	45,115	45,906	46,011	45,661	45,215	0.4	0.1
Great Lakes and Seaway	Shipped	5,760	5,660	5,455	5,494	5,569	5,607	5,614	-0.4	0.2
	Received	6,846	6,789	6,737	6,864	6,960	7,018	7,033	0.0	0.2
Washington/Oregon Coast	Shipped	5,774	5,230	5,804	6,440	6,558	6,567	6,572	0.8	0.2
	Received	5,884	5,337	5,925	6,582	6,711	6,738	6,758	0.9	0.2
Columbia Snake Willamette River	Shipped	2,130	1,825	2,044	2,264	2,246	2,188	2,157	0.5	0.4
	Received	5,397	4,814	5,253	5,702	5,650	5,532	5,467	0.4	0.3
California Coast	Shipped	26,329	21,058	24,472	27,838	27,005	25,637	25,092	0.4	0.8
	Received	22,495	17,238	20,505	27,681	22,792	21,455	20,851	0.4	1.0
Alaska	Shipped	2,117	1,871	2,164	2,466	2,486	2,464	2,464	1.2	0.0
	Received	2,075	2,069	2,322	2,595	2,726	2,813	2,853	1.7	0.7
Hawaii and Pacific Territories	Shipped	1,574	1,292	1,433	1,579	1,504	1,417	1,376	0.0	-1.1
	Received	1,995	1,675	1,823	1,978	1,888	1,787	1,738	-0.1	1.0
Domestic Caribbean	Shipped	28,364	29,334	31,304	34,302	36,210	37,615	38,252	1.5	0.9
	Received	3,329	3,329	3,329	3,329	3,329	3,329	3,329	0.0	0.0
Total	Shipped	364,418	355,684	348,943	367,163	366,051	365,867	366,145	0.1	0.0
	Received	364,418	355,684	348,943	367,163	366,051	365,867	366,145	0.1	0

a - less than 500 tons

Table XI-4

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL, AND THROUGH

COMMODITY Petroleum and Coal Products
ALTERNATIVE Trendlong2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	3,124	3,220	3,330	3,502	3,723	3,917	4,018	0.9	1.1
Lower Upper Mississippi	12,091	12,307	12,489	13,073	13,782	14,584	15,099	0.6	1.1
Lower Mississippi	24,229	24,235	24,762	26,366	27,549	28,868	29,662	0.7	0.9
Baton Rouge to Gulf	59,813	59,719	59,312	65,329	66,613	68,553	69,971	0.7	0.5
Illinois River	8,352	8,370	8,381	8,742	9,162	9,628	9,944	0.4	1.0
Missouri River	436	473	508	555	601	654	690	1.9	1.7
Ohio River	22,294	22,305	22,491	23,641	24,712	25,815	26,424	0.5	0.9
Tennessee River	2,121	2,104	2,300	2,572	2,803	3,043	3,194	1.5	1.7
Arkansas River	2,075	2,038	1,953	1,939	1,866	1,817	1,793	-0.5	-0.6
Gulf Coast West	89,324	89,040	81,040	87,407	88,972	91,485	93,283	-0.2	0.5
Gulf Coast East	27,929	27,407	27,108	28,116	28,311	29,006	29,512	0.1	0.4
Warrior River System	5,475	5,560	5,780	6,262	6,538	6,874	7,090	1.0	1.0
Great Lakes	7,924	7,809	7,688	7,787	7,869	7,914	7,923	-0.1	0.1

a - less than 500 tons

Table XI-5

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON-MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY: Petroleum and Coal Products
ALTERNATIVE: Trendlong2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	730	749	766	797	837	875	895	0.7	0.9
Lower Upper Mississippi	1,712	1,739	1,773	1,868	1,979	2,112	2,202	0.7	1.3
Lower Mississippi	12,512	12,570	12,851	13,711	14,432	15,254	15,766	0.7	1.1
Baton Rouge to Gulf	6,610	6,562	6,167	6,645	6,736	6,893	7,008	0.0	0.4
Illinois River	1,355	1,356	1,361	1,420	1,487	1,568	1,624	0.4	1.0
Missouri River	92	100	107	117	127	138	146	1.9	1.7
Ohio River	8,414	8,358	8,316	8,756	9,074	9,451	9,682	0.3	0.8
Tennessee River	645	632	675	742	804	872	917	1.1	1.6
Arkansas River	490	484	462	455	438	427	421	-0.6	0.6
Gulf Coast West	9,998	9,967	9,909	10,755	11,000	11,420	11,747	0.6	0.7
Gulf Coast East	2,413	2,362	2,321	2,390	2,404	2,459	2,498	-0.1	0.3
Warrior River System	223	226	236	257	270	285	294	1.1	1.1
Great Lakes	1,700	1,771	1,717	1,731	1,763	1,781	1,785	-0.3	0.2
Total	46,994	46,877	46,660	49,645	51,351	53,535	54,986	0.4	0.8

a = less than 500,000 ton-miles

Table XI-6

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY: Petroleum and Coal Products
ALTERNATIVE: TrendLong2003A

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	1,083	998	848	729	626	537	490	-3.0	3.0
	Imports	278	263	270	284	268	256	251	0.2	0.9
Illinois River	Exports	500	456	392	337	289	248	227	3.0	3.0
	Imports	a	a	a	a	a	a	a	0.0	0.0
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	3,520	3,213	2,759	2,369	2,034	1,747	1,595	3.0	3.0
	Imports	2,117	2,041	2,039	2,065	2,006	1,962	1,944	0.2	0.5
Gulf Coast East	Exports	1,250	1,141	980	841	723	620	566	3.0	3.0
	Imports	2,981	2,599	2,532	2,602	2,330	2,130	2,050	1.0	1.8
Warrior River System	Exports	3	2	2	2	2	1	1	3.0	3.0
	Imports	9	8	9	9	9	8	8	0.3	-1.2
South Atlantic Coast	Exports	27	25	21	18	16	13	12	-3.0	3.0
	Imports	10,434	8,951	8,639	8,851	7,821	7,064	6,762	1.3	2.0
Middle Atlantic Coast	Exports	533	486	417	358	308	264	241	3.0	1.0
	Imports	46,646	41,061	39,893	40,700	36,814	33,963	32,825	1.0	1.6

Table XI-6 (continued)

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Exports	35	32	27	23	20	17	16	3.0	-3.0
	Imports	17,571	15,546	15,120	15,411	14,003	12,970	12,558	-1.0	1.6
Great Lakes and Seaway	Exports	71	65	56	48	41	35	32	3.0	-3.0
	Imports	2,135	2,130	2,128	2,129	2,125	2,122	2,121	0.0	0.0
Washington/Oregon Coast	Exports	2	2	1	1	1	1	1	-3.0	3.0
	Imports	123	110	107	109	99	92	90	1.0	1.5
Columbia Snake Willamette River	Exports	15	13	12	10	9	7	7	3.0	3.0
	Imports	30	27	27	27	25	23	21	0.9	1.3
California Coast	Exports	3,852	3,515	3,019	2,592	2,226	1,912	1,745	3.0	3.0
	Imports	1,602	1,424	1,393	1,426	1,299	1,206	1,168	-0.9	1.5
Alaska	Exports	1,089	994	854	733	630	541	493	3.0	3.0
	Imports	737	737	737	737	737	737	737	0.0	0.0
Hawaii and Pacific Territories	Exports	32	29	25	21	18	16	14	3.0	3.0
	Imports	3,129	2,905	2,887	2,952	2,782	2,656	2,605	0.4	-1.0
Domestic Caribbean	Exports	8	7	6	5	5	4	4	3.0	3.0
	Imports	6,079	5,692	5,912	6,317	5,899	5,572	5,434	0.7	1.2
Total	Exports	12,019	10,969	9,420	8,089	6,946	5,965	5,444	3.0	3.0
	Imports	93,871	83,495	81,692	83,618	76,218	70,761	68,576	0.9	-1.5

a = less than 500 tons

increases in originated and terminated domestic traffic, reflecting increased demand and supply (at the aggregate petroleum and coal product level) in the states bordering the rivers, ranging from .1% per year to 1.3% per year growth for originations for 1977-1990 and .2% per year to 2.1% per year for terminations, while originations grow at .4% per year to 1.7% per year for 1990-2003 and terminations grow at .5% per year to 1.7% per year. Growth is highest along low traffic level (Missouri, Tennessee) segments and lowest for high traffic level (Ohio, Illinois, Baton Rouge-Gulf). Gulf Coast West and Gulf Coast East both exhibit minor decreases in originated shipments for 1977-1990 and minor increases in originated shipments for 1990-2003. This weak growth reflects the weak growth in aggregated petroleum product demands during the 1977 1990 period and a reversal to stronger demand growth through 2003. Since these segments ship large quantities of products to many regions, including the declining flows to the North Atlantic and Middle Atlantic, the declining 1977-1990 flows are to be expected. Terminations for the Gulf Coast West increases for the 1977-2003 period reflecting strong demands for petroleum products throughout Texas and Louisiana, while Gulf Coast East terminations decline through 1977-1990 and increase at a slow rate (.2%) for 1990-2003 reflecting lower demand growth than in the Gulf Coast West. The South Atlantic, Middle Atlantic, and North Atlantic Coasts are all considerable net receivers of petroleum products, although the Middle Atlantic reships considerable quantities of products to the North and South Atlantic Coasts, and to itself. These flows generally trend downward, reflecting the declining demands in New England and Middle Atlantic states, and weak demand growth in the South Atlantic states. Domestic Caribbean shipments increase slowly over time relfectng increasing shipments of petroleum products to the United States, especially distillate fuels and jet fuels. West Coast product shipments generally increase for 1977-1990 and decline for 1990-2003 reflecting slower growth in product demand and pipeline competition.

Tonnage traffic for movements traversing all or part of and NWS Analysis Segment generally follow the same trends as the trends for originated and terminated traffic by segment discussed above, and typically reflects growth rates between the originated and terminated traffic growth rates. Exceptions to this are those segments which are traversed in traveling to anoher segment whose growth rate

is higher than that of the segment being traversed. Examples of this are Lower Upper Mississippi and the Upper Mississippi, where terminating shipments on the Upper Mississippi boost Lower Upper Mississippi tonnage growth rates above the growth rates for Lower Upper Mississippi originations and terminations. Ton-mile changes by segment typically closely follow the tonnage changes, although the Gulf Coast West and Gulf Coast East exhibit reversal of tonnage and ton-mile changes due to changing lengths of haul.

Foreign trade in petroleum products is predominantly imports, with the United States being a considerable net importer of petroleum products. Exports of petroleum products are predominantly from th Gulf Coast and the California Coast. These are expected to decline in the future at approximately 3% per year as the nation conserves petroleum products for internal use. The primary recipients of petroleum product imports are to the East Coast and Domestic Caribbean. The principal component of product imports to the North, Middle and South Atlantic Coasts are residual fuels, although other petroleum products are present while the Domestic Caribbean principally receives petrochemical feedstocks (resulting from an adjustment to traffic between WCCS 2920, 'Coke, Petroleum Coke,' flows and WCCS 3313, 'Coke, Petroleum Asphalts, Solvents' flows to remove petroleum related components of WCCS 3313 from WCCS 3313 and shift them into WCCS 2920). Imports of gasoline, jet fuel, kerosine, distillate fuels and 'other' products except the WCCS 3313/WCCS 2920 adjustment are expected to stay constant in the future as the opposing desires of OPEC to export expensive crude and the United States' desire to retain control over refining operations leads to a standoff. The declining import tonnages principally reflect residual fuel imports, although the WCCS 3313/WCCS 2920 adjustment imports are also declining over time.

Major flow patterns in petroleum products are expected to continue in their current patterns. Major originating segments of Middle Atlantic Coast, Gulf Coast West, Baton Rouge-Gulf, imports, and domestic Caribbean remain prominent, although the Middle Atlantic and imports lose substantial tonnage by 2003, and the domestic Caribbean gains substantial tonnage. Major terminating segments of Middle Atlantic Coast, North Atlantic Coast, South Atlantic

Coast, Gulf Coast East, Baton Rouge-Gulf, California Coast and exports are expected to remain prominent although Baton Rouge-Gulf, Gulf Coast West, and California Coast gain substantial tonnage while the Middle Atlantic and North Atlantic Coasts lose substantial tonnage, and exports fall by more than half by 2003.

The major risks associated with the forecast are the price trajectory on crude petroleum pursued by OPEC, which affects the demand for petroleum products and consequently waterborne and pipeline flow levels, the construction of LOOP (Louisiana Off-shore Oil Port) (and potentially the Texas Superport) which affect the growth rate of refinery capacity in the Gulf Coast, and consequently the growth rate of originations from segments contained with the Gulf Coast, and the level of pipeline competition, which directly affects the level of waterborne transportation of petroleum products.

XII - STONE, CLAY, GLASS AND CONCRETE PRODUCTS

INDUSTRY OUTLOOK

Since no model of stone, clay, glass and concrete product output and consumption was available, special models of cement as well as other stone, clay and glass products were developed using forecasts from the Macro Model of the United States Economy. United States domestic cement production, imports and consumption were analyzed and found to depend on the level of United States construction activity. Historical waterborne cement movement closely correlated with United States cement consumption for all traffic classes. Other stone, clay and glass products moving by water were directly related to production activity in that industry over time. In addition, lime - a major component of other stone, clay and glass products - is extensively used as a flux in the steel industry. The Steel Industry Model provided a forecast of total lime consumption for use in the analysis.

(a) Industry Background

In 1977, the United States cement industry produced about 80 million tons of cement relative to an estimated plant capacity of 95 million tons. Imports, a steadily growing share of United States cement use, were over 4 million tons, 5% of total consumption. By 1979, imports satisfied 10% of total United States consumption. Nearly one-half of the cement imported into the United States came from Canada via cross Lakes movements. Western Europe and Japan also provided cement imports to the United States.

Over 42% of cement production capacity is concentrated in five states: California, Pennsylvania, Texas, Michigan, and Missouri. In addition to approximately 170 cement plants, about 250 regional distribution terminals are operated by cement manufacturers and importers for marketing in areas of greatest demand.

Shipments from cement mills in the United States have fluctuated around 80 million tons per year in the 1970s. Imports of cement have risen from 2.6 million tons in 1979

to over 10 million tons in 1979. Major growth areas for cement use in the later 1970s have been the West Coast and the Southwest, primarily due to increased industrial/ commercial construction.

Two major technological shifts in the cement industry over the next twenty-five years include reduction in energy use in producing cement as well as greater durability of the concrete product.

The lower energy use will help keep cement competitive as a primary building material in the United States. On the other hand, appreciable improvements in the durability and resistance to corrosion of concrete will reduce replacement demands somewhat.

The United States consumes about 10% of total world cement production, a share that is expected to decline as Third World countries enjoy rapid economic development in the next quarter century. The United States imported cement share of domestic use will likely climb as United States reserves become more difficult and costly to exploit. Canada, Japan, and Spain will be likely sources for future cement imports.

In 1977, lime producers shipped about 26 million tons of lime or lime-related products. Six states - Ohio, Pennsylvania, Missouri, Texas, Michigan and Alabama - accounted for 55% of total output. Exports and imports are only a very minor part of total industry shipments.

Chemical and industrial lime use makes up over 80% of total consumption, with agriculture use 5% and construction 7%. The steel industry is the main user of lime, principally as a fluxing agent in the ore reduction process. Leading consuming states are Ohio, Pennsylvania, Michigan, Indiana, Texas, New York and Illinois accounting for over 60% of total United States lime usage in the late 1970s.

Lime production is closely related to capacity shifts in the United States steel industry, especially away from

basic oxygen furnaces, a major lime consumer. In addition, lime is used in water purification, paper and pulp and sugar refining. However, steel industry growth will be the major source of new demand over the next quarter century.

Lime is dependent on coal and natural gas as primary energy sources, with the capability to shift among energy types fairly straightforward. An almost complete shift to coal by the end of the century for energy in lime production is expected.

Other stone, clay and glass products include glass products, structural clay products and miscellaneous nonmetallic minerals. Much of this production is located in the South, with Georgia, Texas, Ohio and Alabama as leading states. Exports represent only about 5% of total production, with imports negligible in most consumption activity.

(b) National and Regional Forecasts

Only national level forecasts of cement, lime and other stone, clay and glass products were developed for the study, due to the absence of reliable regional production and use data for these commodities. Table XII-1 summarizes the forecasts of major explanatory factors used in the stone, clay, glass and concrete products for the Trendlong scenario.

The United States demand for hydraulic cement is forecast to increase to almost 113 million tons per year by 2003, with more rapid growth (1.7% per year) in the 1980s than in the 1990 to 2003 period (0.7% per year). Slower growth in highway construction, as well as in highway repair, is a major factor in low growth rates in the next two decades. Although construction of new residential and commercial structure is expected to be strong in the early 1980s, reduced population and economic growth in the late 1980s and beyond also slows the demand for cement.

Table XII-1

National Waterways Study

Stone, Clay, Glass and Concrete Products
Explanatory Factors

Scenario - TRENDLONG2003A

	Years							% Growth	
	1977	1980	1985	1990	1995	2000	2003	77-90	90-03
Total United States Consumption Production and Imports (Mil. Tons)	83.4	87.5	102.1	103.8	104.1	108.6	112.9	1.7	0.7
Total Steel Industry Lime Use Millions of Tons	26.1	28.6	31.6	32.9	34.1	36.2	37.2	1.8	1.0
Investment in Total Structures Billions of 1972 Dollars	96.5	102.0	124.8	127.5	128.0	135.0	141.8	2.2	0.8
Industrial Production Index Stone, Clay and Glass Products	1.461	1.641	2.041	2.192	2.368	2.665	2.902	3.2	2.2
Imports by End-Use Categories Supplies and Materials, Ex. Fuels (Bill. $)	16.1	17.5	24.9	30.2	35.9	43.2	48.4	5.0	3.7
Exports by End-Use Categories Supplies and Materials (Bill. $)	15.9	17.8	21.9	25.4	29.6	34.6	38.0	3.7	3.1

Steel industry lime consumption is expected to grow to over 37 million tons in 2003, up from 26 million tons of flux in 1977. The average yearly compound growth rate over the next 25 for lime use is about 1.4%.

Production activity in stone, clay and glass products is forecast to grow at 3.2% per year to 1990 and 2.2% per year to 2003. Imports of supplies and materials (including cement) will have strong growth (5% per year) in the 1980s as more cement is purchased from Canada and other countries. Exports of supplies and materials average about 3.4% over the next 25 years.

Growth under the two alternative macroeconomic scenarios is not substantially different than under the Trendlong forecast. Under both the Badenergy and Largergovt scenarios, growth is slightly slower for cement and lime use, with imports slightly higher for cement under Badenergy. This is due to the higher United States energy costs relative to other countries, making cement imports cheaper.

(c) Key Industry Developments

Cement forecasts assume that, although imports will increase substantially over the next quarter century, they will not make up over 25% of United States cement use by 2003. Higher United States energy costs could make foreign cement more competitive in the United States market, favoring water transportation to final markets as well as across the Great Lakes from Canada.

Similarly, increased steel imports could lead to lower United States production and reduced lime consumption. In addition, shift to electric furnaces away from basic oxygen furnaces (BOF) could also result in lower lime use. Other steel furnace types use substantially less lime per unit inputs than the BOF process.

DISTRIBUTION SYSTEM

Cement production capacity in the United States is spread across 40 states, with plant location generally

within 200 miles of highly populated areas. Producers tend to be regional in distribution focus, with no cement firms serving the entire United States market. In the 1970s, 200 miles was considered to be the limit for economical land transportation of cement. Final distribution to consumption site tends to be by truck, although railroads and barge are involved in the bulk haulage of cement among regions.

Lime movements tend to be by rail or water to final consumers in the cement industry. In addition, the location of many lime producers in Ohio, Indiana and Pennsylvania favors truck hauls for movements to the steel industry.

(a) Role of Water Transportation

Inland waterway cement traffic originations are concentrated on the Upper Mississippi River and the Ohio River. The Great Lakes shipped approximately twice the total inland cement originations in the late 1970s, including substantial imports from Canada. Other major import areas for cement include the Washington/Oregon Coast and the Middle and South Atlantic Coast. About 12% of total United States cement consumption in any year moves by waterways at some point in the distribution process.

The Upper and Lower Mississippi River, Illinois River, Ohio River and Gulf Coast were major terminations for waterborne cement movements in the 1970s. The Atlantic Coast, Great Lakes and Washington/Oregon Coast are major coastal recipients of waterborne cement.

Other stone, clay and glass products (including lime) waterborne traffic had originations concentrated on the Upper Mississippi, Illinois, and Ohio Rivers as well as the Gulf Coast East. Receipts for these products moving via waterways are the Lower Mississippi River, Illinois River, Ohio River, Gulf Coast East and the Warrior River System.

(b) Factors Affecting Modal Choice

Cheaper water transportation has allowed some cement distribution terminals to locate more than 1000 miles from the production plant. In particular, flows via the Mississippi River from above St. Louis to Gulf Coast consumption areas are not uncommon. For the most part, trucks perform the final haul of hydraulic cement to consumption sites. Rails are heavily involved in bulk haulage of cement to nonwater served regions, while barge as a definite advantage in transportation cost to water served areas.

Distribution of lime products via water is controlled by consumption site location, especially the steel industry. Substantial investments in Great Lakes bulkers and terminals for lime and cement movements implies that these systems will be maintained in the future.

(c) Distribution System Changes

Due to the increasing costs of transporting hydraulic cement long distances to consumers, change in the distribution system favoring waterways may occur in the 1980s. In addition, growing environmental problems with relocating cement production plants implies that long-haul water flows from plant to distribution terminal may be dictated by industry economics. About 40% of the growth in cement movements of the waterways over the next two decades is expected to be due to these factors. No major shifts are forecast for distribution systems in other stone, clay, glass and concrete products.

WATERBORNE DEMAND PROJECTIONS

Waterborne traffic flow projections followed a general methodology: First, cement, lime and other stone, clay and glass product flows for all traffic classes by water are forecast at the national level. For internal, lakewise, and coastwise flows, relationships between waterborne traffic and economic activity indicators by industry were developed. For local, interterritorial local and sometimes coastal flows, relations to United States import/

export traffic by commodity were examined. Import and export movements by water were forecast based on International Economic Model projections.

Due to the large number of possible origin - destinations, modal share changes can only be analyzed for major waterborne flows. In the case of cement traffic, increases in the share of downbound movements on the Mississippi River due to growing long-haul shipment activity was included in the forecast. No changes were assumed in modal shares for lime or other stone, clay and glass products.

The disaggregation of national forecasts to waterborne commodity flows involved using indices (1977 = 1.00) through 2003 to expand waterways traffic by commodity and traffic class for waterway segment pairs. For example, the Great Lakes (lakewise) limestone traffic index is used to expand all 1977 waterborne traffic flows in the data base related to lakewise limestone movements.

After the basic expansion of the 1977 flows by commodity was completed for each NWS macroeconomic scenario, any additional or new flows are edited into the forecast data base. Finally, the waterborne flows are aggregated up to reporting segments and final ton - miles for internal segments are calculated.

(a) Summary

Tables XII-2 to XII-5 summarize the waterborne demand projections for stone, clay, glass and concrete products through the year 2003. Trendlong projections are discussed in detail; alternative macroeconomic forecast tables for this commodity are included in Appendix B.

Overall Table XII-2 indicates that total domestic waterborne flows in stone, clay, glass and concrete products will grow from about 12 million tons in 1977 to over 25 million tons by the year 2003. Through 1990, demand will increase by a compound annual rate of 4.0%, with the rate declining to 2.1% after 1990 through 2003. Cement

traffic is the subcomponent of this category that is responsible for majority of growth during the forecast period.

The Atlantic Coast segments experience the strongest growth in domestic shipments during the forecast period as cement imports are moved to distribution terminals as well as final consumers. For the inland system, the Ohio River, Gulf Coast waterways and the Lower Mississippi River are the segments likely to have the most rapid growth over the next twenty-five years.

Domestic traffic activity in stone, clay, glass and concrete products will be concentrated on the Mississippi River, Illinois River, Ohio River, Gulf Coast waterway and the Great Lakes segments. Table XII-3 contains forecasts of total segment traffic activity from 1977 to 2003. Stone, clay, glass and concrete products will double on the Ohio River, from 1.7 million tons to 3.5 million tons. Great Lakes traffic in cement and lime will grow by an average of 2.2% per year during the forecast period.

Table XII-4 contains estimated segment ton-miles for stone, clay, and glass products. Ton-mile growth is more pronounced on the Great Lakes and the Ohio River, with Lower Mississippi increases also quite significant. Overall, ton-miles for stone, clay, glass and concrete products are expected to grow by about 2.0% per year between 1977 and 2003.

Table XII-5 shows that total stone, clay, glass and concrete products foreign trade activity will see total imports growing from .9 million tons in 1977 to 5.5 million by the year 2003. Import growth will be concentrated in the Great Lakes, Atlantic Coast and the Washington/Oregon Coast. Exports expected to grow by 3.4% per year from 1977 to 2003, will be concentrated along the South Atlantic Coast as well as the Gulf.

(b) Major Market Shifts

The only major market change expected in stone, clay, glass and concrete products is the increase in long-haul

Table XII-2

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY Stone, Clay, Glass, and Concrete Products
ALTERNATIVE TrendTong2003A

SEGMENT	IN/OUT	1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
Upper Mississippi	Shipped	1,372	1,412	1,635	1,662	1,667	1,737	1,804	1.5	0.6
	Received	407	419	485	493	495	516	535	1.5	0.6
Lower Upper Mississippi	Shipped	1,411	1,523	1,911	2,069	2,209	2,454	2,649	3.0	1.9
	Received	198	204	236	239	240	250	259	1.5	0.6
Lower Mississippi	Shipped	5	6	9	10	11	13	14	4.9	3.0
	Received	1,057	1,145	1,459	1,568	1,678	1,870	2,022	3.1	2.0
Baton Rouge to Gulf	Shipped	57	60	72	75	77	83	87	2.1	1.2
	Received	84	87	104	107	110	117	121	1.9	1.1
Illinois River	Shipped	68	71	86	90	93	100	106	2.2	1.3
	Received	1,095	1,173	1,469	1,563	1,656	1,826	1,962	2.8	1.8
Missouri River	Shipped	147	152	175	178	179	186	193	1.5	0.6
	Received	148	153	177	180	181	189	196	1.5	0.7
Ohio River	Shipped	1,173	1,291	1,693	1,847	2,009	2,274	2,480	3.6	2.3
	Received	1,105	1,193	1,512	1,621	1,730	1,922	2,074	3.0	1.9
Tennessee River	Shipped	19	22	32	37	42	50	56	5.4	3.3
	Received	66	68	80	82	84	88	92	1.7	0.9
Arkansas River	Shipped	3	3	5	6	7	8	9	5.8	1.4
	Received	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Shipped	246	256	297	304	307	322	335	1.7	0.7
	Received	413	435	522	543	561	603	619	2.1	1.1
Gulf Coast East	Shipped	580	679	980	1,119	1,276	1,506	1,680	5.2	3.2
	Received	592	662	880	971	1,067	1,216	1,311	3.9	2.5
Warrior River System	Shipped	129	137	161	167	171	180	188	2.0	0.9
	Received	216	250	356	403	457	536	576	4.9	3.1
South Atlantic Coast	Shipped	141	194	251	301	341	391	423	6.0	2.7
	Received	410	643	842	1,066	1,236	1,421	1,524	7.6	2.8
Middle Atlantic Coast	Shipped	1,938	3,036	3,975	5,073	5,835	6,708	7,194	7.6	2.8
	Received	947	1,482	1,941	2,456	2,847	3,271	3,510	7.6	2.8

Table XII-2 (continued)

SEGMENT	IN/OUT	YEARS 1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Shipped	17	27	36	46	53	61	65	7.8	2.8
	Received	634	1,010	1,324	1,686	1,960	2,254	2,415	7.9	2.8
Great Lakes and Seaway	Shipped	3,603	3,883	4,435	5,047	5,565	6,006	6,285	2.6	1.7
	Received	3,449	3,725	4,254	4,863	5,322	5,817	6,089	2.7	1.7
Washington/Oregon Coast	Shipped	399	479	608	685	752	846	911	4.2	2.2
	Received	255	291	365	404	436	484	519	3.6	1.9
Columbia Snake Willamette River	Shipped	25	29	39	44	49	58	64	4.6	2.9
	Received	15	20	28	34	39	46	51	6.6	3.2
California Coast	Shipped	162	209	270	312	350	401	435	5.2	2.6
	Received	33	44	56	66	75	85	92	5.5	2.6
Alaska	Shipped	6	9	11	14	16	18	20	6.4	2.7
	Received	186	252	328	390	442	507	548	5.9	2.6
Hawaii and Pacific Territories	Shipped	117	175	228	284	327	375	403	7.0	2.7
	Received	229	302	391	458	516	590	641	5.5	2.6
Domestic Caribbean	Shipped	35	35	35	36	36	36	36	0.1	0.1
	Received	116	130	157	169	182	203	219	2.9	2.[illegible]
Total	Shipped	11,655	13,687	16,965	19,364	21,313	23,813	25,438	4.0	2.1
	Received	11,655	13,687	16,965	19,364	21,313	23,813	25,438	4.0	2.1

a = less than 500 tons

Table XII-3

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC INBOUND, OUTBOUND, LOCAL, AND THROUGH
COMMODITY Stone, Clay, Glass, and Concrete Products
ALTERNATIVE Trendlong2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	1,390	1,430	1,656	1,684	1,690	1,761	1,829	1.5	0.6
Lower Upper Mississippi	2,055	2,188	2,705	2,859	3,005	3,287	3,517	2.6	1.6
Lower Mississippi	1,343	1,440	1,804	1,921	2,035	2,245	2,414	2.8	1.8
Baton Rouge to Gulf	366	380	447	459	466	492	516	1.8	0.9
Illinois River	1,181	1,263	1,576	1,674	1,769	1,946	2,089	2.7	1.7
Missouri River	148	153	177	180	181	189	196	1.5	0.7
Ohio River	1,709	1,871	2,429	2,637	2,854	3,214	3,496	3.4	2.2
Tennessee River	82	87	107	113	119	130	139	2.5	1.6
Arkansas River	3	3	5	6	7	8	9	5.8	3.4
Gulf Coast West	436	461	555	579	599	644	682	2.2	1.3
Gulf Coast East	945	1,061	1,425	1,578	1,742	1,996	2,191	4.0	2.6
Warrior River System	343	385	513	567	624	713	780	4.0	2.5
Great Lakes	3,613	3,893	4,449	5,061	5,521	6,024	6,304	2.6	1.7

* = less than 500 tons

Table XII-4

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY: Stone, Clay, Glass, and Concrete Products
ALTERNATIVE: Trendlong2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	229	236	273	277	278	290	301	1.5	0.6
Lower Upper Mississippi	281	304	370	390	408	445	475	2.6	1.5
Lower Mississippi	467	496	611	645	676	738	788	2.5	1.6
Baton Rouge to Gulf	46	48	57	59	60	64	67	1.9	1.0
Illinois River	313	335	417	443	468	515	552	2.7	1.7
Missouri River	38	39	46	46	46	48	50	1.5	0.6
Ohio River	474	529	710	783	862	987	1,083	3.9	2.5
Tennessee River	33	36	44	4	50	55	59	2.7	1.7
Arkansas River	*	1	2	2	2	3	3	5.8	3.4
Gulf Coast West	46	48	58	61	63	67	71	2.2	1.2
Gulf Coast East	61	68	89	97	106	120	131	3.6	2.3
Warrior River System	11	12	16	18	19	22	24	3.8	2.4
Great Lakes	1,579	1,703	1,945	2,219	2,424	2,647	2,770	2.6	1.7
Total	3,582	3,852	4,638	5,086	5,463	6,000	6,375	2.7	1.8

* = less than 500,000 ton miles

Table XII-5

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE
COMMODITY: Stone, Clay, Glass, and Concrete Products
ALTERNATIVE: Trend(long)2003A

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	82	92	110	125	143	164	179	3.3	2.8
	Imports	123	217	171	176	176	183	194	2.7	0.6
Illinois River	Exports	8	8	8	8	4	8	8	3.1	2.7
	Imports	13	19	16	16	16	17	17	1.6	0.4
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	50	57	69	79	92	106	116	3.7	3.0
	Imports	225	380	305	309	310	321	332	2.5	0.5
Gulf Coast East	Exports	37	43	51	58	67	77	84	3.5	2.9
	Imports	219	410	319	325	326	340	351	1.1	0.6
Warrior River System	Exports	19	21	25	29	33	38	41	3.2	2.8
	Imports	3	3	3	3	3	3	3	0.0	0.0
South Atlantic Coast	Exports	123	139	167	191	219	252	275	3.4	2.9
	Imports	545	957	763	772	774	803	812	2.7	0.6
Middle Atlantic Coast	Exports	336	348	[illegible]	464	528	604	635	[illegible]	2.7
	Imports	704	999	[illegible]	858	859	880	894	1.5	0.4

Table XII-5 (continued)

SEGMENT	EXP/IMP	1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
North Atlantic Coast	Exports	2	2	3	3	3	4	4	2.9	2.6
	Imports	12	13	12	12	12	12	12	0.0	0.0
Great Lakes and Seaway	Exports	50	69	91	109	131	158	176	6.2	3.7
	Imports	777	1,446	1,128	1,147	1,150	1,199	1,246	3.0	0.6
Washington/Oregon Coast	Exports	21	29	39	47	57	68	76	6.5	3.8
	Imports	730	1,316	1,036	1,053	1,056	1,098	1,139	2.9	0.6
Columbia Snake Willamette River	Exports	1	1	1	1	1	1	2	3.0	2.7
	Imports	14	14	14	14	14	14	14	0.0	0.0
California Coast	Exports	36	40	47	54	62	71	77	3.2	2.8
	Imports	277	294	279	280	280	280	280	0.1	0.0
Alaska	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	79	133	107	109	109	113	117	2.5	0.5
Hawaii and Pacific Territories	Exports	a	a	a	a	a	1	1	3.3	2.8
	Imports	4	5	4	4	4	4	4	0.0	0.0
Domestic Caribbean	Exports	50	68	90	108	130	156	173	6.2	3.7
	Imports	57	89	73	74	74	76	78	2.0	0.5
Total	Exports	787	911	1,103	1,269	1,465	1,699	1,858	3.7	3.0
	Imports	3,783	6,294	5,081	5,151	5,163	5,343	5,516	2.4	0.5

a = less than 500 tons

cement traffic on the Mississippi and Ohio River systems. The primary reason is the inability to easily relocate cement plants due to environmental restrictions, coupled with the growth of demand for cement in areas with minimal existing production capacity. The result will be increased downbound cement flows from the Upper Mississippi to both Gulf and Ohio River destinations.

Substantial amounts of flows by rail are also expected, as growth in cement demand in non-water served regions such as the Southwest and West is likely over the next 25 years. No changes in commodity mix for waterborne flows for this category commodity are expected.

(c) Waterborne Flows Development

As previously mentioned, Ohio River, Great Lakes and Mississippi River stone, clay, glass and concrete product flows are likely to experience the most rapid growth in the forecast period. No new flows were added for these commodities during the next 25.

The major forecast risk is potential upbound (received) cement traffic on the Arkansas River for use in construction activity in the Southwest. A possible flow of 100,000 tons per year - with originations on the Upper Mississippi could occur, depending on regional cement production capacity constraints.

XIII - PRIMARY METALS PRODUCTS

INDUSTRY OUTLOOK

Activity in the primary metals industry is forecast in several component parts for the National Waterway Study. The domestic demand for steel mill products in 21 specific end-markets is forecast based on activity indices in the steel consuming industries, industry-specific steel use-factors, and prices for steel and substitute materials. The market shares of imported versus domestic mill product supplies is determined by relative prices for each.

The demand for coke by the steel industry is related to blast furnace production by region which is in turn dependent on raw steel production by furnace type and estimated improvements in the ratio of net coke per ton of pig iron. Although coke as a commodity is included with petroleum products, industry shipments depend on steelmaking activity, not petroleum production. Thus, coke is discussed and forecast in the context of the appropriate industry sector, primary metals.

Because petrochemical feedstock imports and petroleum coke exports, which are more closely related to petroleum products than primary metals, literally swamp all other components of waterborne "primary metals" traffic, separate estimates are made for blast furnace coke, which are reported in this chapter, and the remainder of the flows which are reported and projected with petroleum products in Chapter XI.

The remainder of the primary metals consist of steel industry inputs and intermediate products or nonferrous metals. The former are forecast based on raw steel production, while the latter are related to industrial demands for nonferrous metals in the United States economy.

(a) Industry Background

1. Steel Mill Products. The United States economy demands steel mill products in a wide variety of forms (from pipe and tube to plate and sheet), both as final

product and for further fabrication. Domestic steel mills shipped 91.1 million tons of steel mill products in 1977, excluding shipments between facilities of a single firm, which accounted for another 20 to 25 million tons. These domestic supplies were further augmented by 19.3 million tons of steel mill product imports. The import share of total steel supplies has fluctuated historically, settling in the 12%-14% range for most of the 1970s but increasing to 17.5% and 17.7% in 1977 and 1978 respectively, and 14.9% in 1979. The higher import market shares of recent years are generally interpreted as unacceptable from a national policy perspective and responses ranging from "jawboning" with foreign governments and producers to trigger price schemes to counter alleged dumping have have proposed and/or implemented.

2. Coke. Coke is used as an input to the steel-making process to fuel the blast furnace as well as to provide carbon to strengthen the resulting pig iron. Apparent consumption of coke followed the general course of the United States domestic steel industry during the 1970s, reaching peaks of 65.8 and 64.1 million tons respectively in 1973 and 1974, before falling to the 54 to 57 million annual range at the end of the decade. The decline is due to reductions in domestic raw steel production, but also a fall off in the blast furnace coke ration and a decline in the pig iron requirements resulting from a shift in furnace mix toward non-coke-using electric furnaces.

Because of environmental restrictions on older United States coke plants and the high cost of rehabilitation and new construction, the import share of domestic coke requirements has risen in recent years. Coke imports rose from less than 200 thousand tons per year in the early 1970s to 3.5 million tons in 1974, and then fell to less than 2 million tons from 1975 to 1977, before reaching a record 5.7 million tons in 1978. A soft steel market abroad also contributed to the surge in 1978.

3. Other Primary Metals. The remaining "primary metals" consist of inputs and intermediate products of the steel industry (pig iron, ferroalloys, and slag) and non-ferrous metal products.

Ferroalloys are input to iron and steel furnaces to alter the attributes of the resulting metal (e.g., for

stainless and heat-resistance properties). The relative growth of speciality steels has caused the demand for ferroalloys to increase faster than raw steel production. Enery cost increases and environmental restrictions as well as the foreign origin of most nonferrous raw materials have led to an increasing import share in total ferroalloy consumption.

Nonferrous metals demand in the United States showed strong growth during the 1970s, due to the energy saving characteristics of light-weight metals such as aluminum in a broad range of traditional metal markets (e.g., automative), as well as the need for special properties such as heat and corrosion resistance. For example, the demand for aluminum metal in the United States rose at a 3.4% per year compound rate between 1968 and 1977, in spite of a large drop in demand in the immediate aftermath of the Arab oil embargo. Over that same period, waterborne imports of all nonferrous metals grew at a rate of 4.8% per year, while the growth in the Federal Reserve Board nonferrous metals industrial production index average .82% per year.

(b) National and Regional Forecasts

1. Steel Mill Products. Steel consumption is expected to follow the broad profile of the economy over the forecast period. In the 1977 to 1980 period, average annual steel consumption growth of only .7% per year reflects the economic recession of 1980 (Table XIII-1). Steel consumption grows at a compound annual rate of 2.6% per year from 1980 to 1990 as business fixed investment moves forward and motor vehicle sales rise. In subsequent years through 2003, the steel consumption growth rate is projected at approximately 2.0% per year, as the economy grows at a 2.5% rate, close to its potential path. The total increase in steel consumption from 1977 to 2003 is projected to be 77.2 million short tons, or 71%.

Steel imports are forecast to decline from a record 21.1 million tons in 1978 to the 16 million ton range in 1979-1980, then rise gradually to 28.1 million tons by 2003. The import share of apparent consumption, however, is projected to decline from 18.1% in 1978 to 15.1% by 2003. Within this long-term net decline in import share, there is a temporary rise during the strong demand period of the mid-1980s.

Table XIII-1

PRIMARY METALS FORECAST
Sceuario Trendlong2003A
(1000'S Short Tons)
STEEL MILL PRODUCTS

	1977	1980	1985	1990	1995	2000	2003	% GROWTH 77 TO 90
Consumption	108,701	110,876	126,610	143,734	158,638	174,371	185,918	2.2
Shipments	91,147	93,491	108,667	122,108	135,138	150,548	160,854	2.3
Imports	19,307	16,261	21,741	24,611	26,293	27,648	28,149	1.9
Exports	2,003	2,373	1,860	1,835	1,952	2,139	2,288	0.7
COKE								
Consumption	48,510	48,682	50,800	51,068	51,578	93,655	54,410	0.4
Imports	1,829	3,974	5,676	5,706	5,767	5,995	6,079	0
OTHER PRIMARY METALS								
Ferralloy Imports	1,013	1,186	1,605	2,047	2,519	3,059	3,420	5.6
Non Ferrous Metals Production Index(1967=100)	1	1	2	2	2	3	3	3.6
Exports	471	471	471	471	471	471	471	0.0
Imports	1,444	1,650	2,551	3,203	3,897	4,786	5,423	6.3

PRIMARY METALS FORECAST
Sceuario Trendlong2003A
(1000'S Short Tons)
STEEL MILL PRODUCTS

	% GROWTH 90 TO 2003
Consumption	2.0
Shipments	2.1
Imports	1.0
Exports	1.7
COKE	
Consumption	0.5
Imports	0.5
OTHER PRIMARY METALS	
Ferralloy Imports	4.0
Non Ferrous Metals Production Index(1967=100)	2.8
Exports	0.0
Imports	4.1

The projected decline in import share reflects the assumptions that growth in world steel demand will reduce excess foreign steel capacity - the difference between capacity and home market demand at given prices - and that United States capacity expansion is financed primarily by some means other than a large steel price increase. Alternative sources of funds include changes in tax laws governing depreciation.

Steel exports are projected to remain in the 2 million ton per year range through the forecast period. Exports benefit from the trend decline in domestic relative to foreign steel prices and from industrial growth abroad. However, the United States advantage should be confined to a selected few products.

Steel shipments are forecast to increase from 91.1 million tons in 1977 to 160.9 million in 2003, an increase of 76.6%, slightly greater than the forecast increase in steel consumption.

Steel consumption is lower in both macroeconomic alternatives than in the Trendlong case due to lower GNP and industrial growth. Consumption under the Largergovt alternative is more severly impacted - 6% (11.4 million tons) lower than Trendlong in 2003 compared to 2.7% (5 million tons) for Badenergy - due to its relatively larger impact on business fixed investment and thus on potential GNP. Steel imports are lower under the Largergovt alternative (5.3%, or 1.5 million tons) due to the decline in consumption. Steel imports under Badenergy are higher than under Trendlong in spite of the decline in consumption, because higher domestic inflation pushes the import market share to 16.9%.

2. Coke. Coke consumption in blast furnaces is forecast to rise from 48.5 million tons in 1977 to 54.4 million tons in 2003, an increase of 12.2%. This small increase is due to a combination of moderate growth of pig iron production and a decline in the ratio of net coke per ton of pig iron. The forecast increase in pig iron production from 1977 to 2003 is 25.1 million tons, or 31%. This growth is smaller than the 51% increase forecast for raw steel production, due to the large shift toward electric furnaces. The forecast decrease in the net coke rate is 12.2%, from 0.5820 tons of coke per ton of pig iron in 1978 to 0.5112 in 2003. Imports are projected to resurge in the mid-1980s, as increased demand presses against

domestic shortages, but increased competition for foreign coke by foreign steel producers and resolution of some of the environmental problems at domestic furnaces will restrain imports to the vicinity of 5.7 million tons (the level forecast for 1985).

3. Other Primary Metals. Ferroalloy consumption is projected to grow at about the same rate as raw steel production over the forecast period (65.5% between 1977 and 2003). Ferroalloy imports grow more rapidly, increasing at 5.6% per year through 1990, and 4.0% per year during the 1990s, with the extra growth driven by the continued substitution of ferroalloy for crude ore imports.

Industrial production of nonferrous metals - as measured by the Federal Reserve Board index - is projected to grow at 3.3% per year between 1977 and 1990, and 2.8% per year thereafter. Imports of nonferrous metal products continue to outstrip production, growing at 5.3% per year through 1990 and 4.1% per year through the 1990s.

(c) Key Industry Changes

There are several contingencies that pose serious risks to the price and import profile discussed above. One is that the pressure of demand on capacity in the mid-1980s could produce a large increase in domestic steel price relative to the price of imported steel, causing a rise in the import share of the market and holding down domestic shipments and production.

A second risk is that foreign steel demand presses upon foreign capacity at the same time that domestic demand is strong. The result could be a very large rise in both domestic and import steel prices, without much change in quantity. The price rise in this case would probably be so large as to disrupt the trend growth of the economy and steel demand. The seriousness of this second risk is highlighted by the recognition that both steel demand and capacity expansion have lagged in Western Europe and Japan as well as in the United States. An upward correction of steel demand is implicit in a restoration of more nearly normal economy growth rates in these major industrialized regions of the non-Communist world, and is likely to occur before substantial capacity additions have been made. In short, imports are not likely to bail out the United

States, which must provide a substantial share of the capacity increase required to support the growth projected for the economy.

Another risk to the forecasts described above relates to the ability of domestic steel producers to meet the productive capability implicit in the steel mill product projections. The difficulty of expanding capacity even by modest amounts is usually illustrated by considering the sources and uses of funds within the steel industry. The major uses of funds, including capacity maintenance, pollution control, and capacity expansion, are described as ever increasing. The supply of funds is commonly described as restricted. New equity is usually ruled out because of the low prices assigned to steel shares by the common market. New borrowing is seen to be limited by rules of prudence regarding debt-equity ratios. Depreciation and deferrals are set by tax laws. Net earnings are often assumed to remain constant at some recent level, such as the 1973-1974 average.

If all these restrictive assumptions regarding supplies of funds were to hold, very little capacity expansion could take place. However, the economy forecast that requires increased capital spending also assumes that conditions are met for such spending, such as tax incentives, accelerated depreciation, faster write-off of pollution control expenditures, and the like. In addition, the steel forecast includes an increase in the average price of steel relative to the steel cost indicator, amounting to about 17% over the 25-year period. This would increase net earnings and, together with the tax and depreciation changes, could facilitate some issue of new equity.

The raw materials component of capability should present no serious capacity problem through the mid-1980s, and domestic producers have developed a materials balance to support the previous 1973 peak production of 150 million tons of raw steel, a level which is not reached again in the forecast until 1985. Reserves of the major materials, coal and ore, are ample, though further development beyond the peak-support level would be costly. This is part of the high capital cost problem that forms a constraint on the blast furnace-basic oxygen combination

as the primary source of additional steel capacity. For other materials, such as ferroalloys, there could be supply problems, particularly as some of the major supply regions are in areas of potential political instability.

Coke ovens also present a risk of bottlenecks, where environmental regulation, age of existing facilities, and capital costs are serious considerations. Some points of flexibility should not be overlooked in the consideration of this issue, however. There is potential for coke savings through increased conversion of basic oxygen furnaces to bottom-blown operations, which would allow an increase in the scrap portion of the metallic charge from the 30% range to the 40%-50% range. There is additional potential for coke savings in use of direct reduced iron in the blast furnace, which improves ore quality sufficiently to lower coke requirements.

DISTRIBUTION SYSTEMS

The distribution systems analysis for primary metals products examined the various factors contributing to the demand for waterborne transportation of the component commodities, including domestic versus foreign origination, direct and indirect cost and rate factors, and loss and damage. The findings form the basis of the waterborne demand projections in the final section of this chapter.

(a) Role of Water Transportation

1. Steel Mill Products. The major role of waterborne transportation in steel mill product distribution is in the transportation of United States foreign trade in steel mill products. Thus, 19.3 million tons of steel were imported in 1977 of which 17.5 million tons (90.5%) entered the country by vessel. Waterborne exports also accounted for 1.6 out of 2.0 million tons of steel mill product exports in that year.

Total domestic waterborne steel product shipments from 1965 to 1977 varied between 6.3 and 9.0 million tons. The bulk of this traffic has been in the "internal"

or inland waterway category with the other traffic types accounting from small and/or declining volumes. As a percentage of total steel available for transportation - gross domestic shipments plus imports - the domestic waterborne tonnage has accounted for a small and declining share. Internal waterborne steel traffic declined from 5.3% to 4.4% of the total from 1971 to 1977, while the total domestic waterborne share was declining from 6.2% to 4.8%. The factors underlying this relatively small share are outlined in the following section.

Steel product foreign trade also bears heavily on domestic waterborne steel transportation. In 1977, 33% (1.9 million tons) of internal barge traffic originated at Lower Mississippi River ports destined for numerous points on the river system, including the Upper Mississippi River (228 thousand tons), Chicago and the Illinois River (515 thousand tons), and the Ohio River (421 thousand tons). This barge traffic is almost entirely import traffic, and accounts for 75% of the imports in that port range. Barge traffic terminating at Lower Mississippi River ports, which is largely export oriented, account for another 338 thousand tons in 1977.

A large and declining portion (664 thousand tons in 1977) involves intra-segment flows. For example, steel product flows within the Monongahela River declined from 910 thousand tons in 1969, to 14 thousand tons in 1977, while flows within the Warrior River system were declining from 344 thousand tons to 39 thousand tons.

Excluding intra-segment traffic and movements to and from Lower Mississippi River ports, barge transportation on the Mississippi River system accounted for 2.6 million tons in 1977 - about 2.8% of domestic steel product shipments, down slightly from earlier years (3.7% in 1971-1972 and 3.5% in 1974-1975). Major barge originating points are the steel producing districts of Pittsburgh (about 1.5 million tons in 1977) and Chicago (900 thousand tons). Terminating areas are considerably more dispersed, with the Houston area receiving 642 thousand tons and 11 other areas receiving between 100 and 300 thousand tons.

2. Coke. In general, coke ovens are located at blast furnace sites, minimizing coke transportation requirements. Thus, 49.4 out of 53.1 million tons of the coke produced in the United States in 1977 was produced at plants related to blast furnaces, and 46.3% was used by

the producing company. Although it is known that some portion of the coke which is shipped moves via barge, it is not possible to isolate it in the historical data from the petroleum products with which it is reported. It is possible to distinguish coal coke destined for the iron and steel industry from the petroleum-based reporting counterparts in the United States foreign trade data. While some of this coke is imported at Lower Mississippi River ports for transshipment to upriver steel plants (10%-15% in recent years), the majority of it is imported for use in port areas. This pattern arises from the fact that the interior regions (particularly in the Ohio River Valley) tend to be coke surplus regions in periods of normal demand, supplying some of the needs of net demand regions nearer to the coasts. In times of tight supplies, these regions keep more of their coke, and the coastal regions import a greater share of their requirements.

3. Other Primary Metals. Water traffic in the other primary metals is heavily foreign trade oriented. Total waterborne traffic of ferroalloys, for example, amounted to 1.79 million tons in 1977, of which 1 million was import traffic, and an additional 506 thousand tons originated at Lower Mississippi River ports.

For nonferrous-metals, 56.4% (1.4 million tons) of total waterborne tonnage represented waterborne imports in 1977, and an additional 18.4% (503 thousand tons) was waterborne exports. Of the domestic activity, 140 thousand tons (22%) involved the Lower Mississippi ports as either an origin or distination.

(b) Factors Affecting Modal Choice

1. Steel Mill Products. Several factors explain why the waterborne share is less than 5% even though the bulk of steel products are produced on or near the inland and coastal waterways. First, there are geographic considerations. Although the steel producing facilities are located on the waterways - for raw materials access or other reasons - steel markets are often located away from the water. The entire manufacturing complex between the Atlantic Ocean, Great Lakes, and Ohio and Mississippi Rivers is bordered by water-served steel manufacturers. Shipments into this area, therefore, tend to be away from,

not along rivers. Major steel-consuming industrial areas along the waterways, on the other hand, are often co-located with steel production activity.

River steel traffic has been boosted by strong, growing steel demand in the Gulf states - a net consuming steel region. In particular, the inability of this region to satisfy the plate and pipe requirements of its own oil industry has provided a continuous outlet for steel products from Chicago, Pittsburgh, and the Ohio River Valley. The location of much oil and shipbuilding activity at waterfront sites - or even at offshore or swampy sites unsuitable for any other mode of transportation - further contributes to water traffic for steel distribution within the Gulf area. Still, even in regional markets with direct head-to-head competition between rail and barge (e.g., Pittsburgh or Chicago to Houston), significant rail activity is evidenced. For example, as much as 75% of domestic pipe and tube moving into the Southwest (Texas, Louisana, Oklahoma, Arkansas) from Midwestern and Eastern producers is by rail.

A second factor discouraging a greater waterborne share of total steel product shipments is the large shipment sizes required for barges. Although line-haul transportation rates between the Middle Ohio River and Houston are considerably higher by railroad than by barge - $27.43 per ton versus $17.79 per ton for wrought iron pipe - the minimum barge shipment under the above tariff is 1,350 tons, while rail movements may be as low as a single carload (50-70 tons). Shipment size was given as the major reason for a low barge share by every steel traffic manager contacted during this study.

A third factor in the choice of rail over barge concerns the longer transit times for barge shipment - three weeks to a month from Chicago and Pittsburgh to Houston compared to one week or less by rail. Increased transit times mean higher inventory costs, either because more of a firm's product is in transit at any one time, or because larger inventories must be carried to insure against stockouts. At 12% to 13% commercial interest rates, a shipper faces a cost penalty of up to $1 - $1.25 per ton, further reducing the barge line-haul rate advantage.

Time also has a second, less tangible, but perhaps more important impact on mode choice. Each of the

major steel producers competes in each major market area in a full range of steel products, whether it produces that good in the region or not. In order to sell that product, it must be competitive in price - which may involve absorbing freight rates - as well as availability. In many cases, the exception being standardized products like most oil country goods, the broad range of alternate specifications with respect to size, metallurgical properties, etc., rules out sales from regional inventories. In such instances, the increased transit time for barge delivery from outside the region might make the firm non-competitive for a particular sale.

A fourth reason given for the choice of rail over barge in a "water-competitive" market is the additional handling costs associated with barge. Rail cars are usually loaded at the steel plant and unloaded at receivers siding, while barge shipment must often be transferred to truck or rail car for ultimate delivery to the purchaser. This transfer currently costs $3.50-$4.00 per ton at Houston. Subsequent cartage to a receiver 100 miles from the port adds another $10 per ton for iron and steel articles and $13 for pipe.

(c) Distribution System Changes

1. Steel Mill Products. Several changes are occuring in the steel industry which may work against the waterway share of gross domestic shipments of steel products. First, growth in the Texas steel industry may reduce the net deficit steel position of that region and thus reduce the market for shipments into that prime waterborne market. Raw steel capacity in Texas is expected to reach 9.5 million tons by 1990 (up from 3.7 million tons in 1970), during which period total United States raw steel capacity is expected to increase by only 26%. This, coupled with expected increases in the import share of steel products - at the Gulf as well as other ports - during the 1980s and 1990s, will tend to work against growth in domestic waterborne steel transportation.

Second, a significant portion of new steel capacity installed in the United States in recent years has been at smaller scrap-based and speciality steel producers, which are often located away from water sites and

produce for markets characterized by high value, small shipments (e.g., high alloy speciality products) or for localized markets (e.g., reinforcing bars). Continuation of such trends, which will be encouraged by increasing transportation costs on all modes will tend to repress growth in barge markets shares.

Finally, mergers and capacity shake-outs may have an impact on barge activity, although the direction of the effect is less certain. A steel corporation may produce certain products in each region (e.g., pipe in Chicago and sheet and plate in the Pittsburgh area), yet at the same time have a commitment to market a full line of products in all regions. This leads to long distance movement of whole product groups to balance out an individual corporation's regional supply mix, and it leads to phenomenon such as interregional cross-hauling of products - i.e., the same product moving both ways between two regions. In a related situation, a company may fabricate pipe at one or more locations and the plate which feeds the pipe mills at an entirely separate site, again possibly requiring interregional steel transportation, and possibly water transportation since a regular, high-volume flow may be implied.

WATERBORNE DEMAND PROJECTIONS

Waterborne demand projections for primary metals products are built up from separate projections for iron and steel products, coke, and other primary metals products. Domestic barge traffic in steel is driven by total domestic mill shipments for segments in steel producing regions, and by steel foreign trade activity to and from Lower Mississippi River ports. Coke demand is represented entirely by import-export demand, with petroleum coke imports and exports and all domestic "coke" traffic projected in the petroleum products section. Other primary metals traffic, which consists predominately of ferroalloys and nonferrous metals is projected based on import-export activity, its dominant source, and market.

(a) Summary

The demand for domestic waterborne primary metals transportation grows 9.1 million tons in 1977 to 11.3

million tons in 1990 (1.7% per year) and then slows slightly (1.6% per year), reaching 13.9 million tons by 2003. Growth is shared equally by iron and steel products - 1.8% per year in the earlier interval and then 1.5% per year thereafter - and other primary metals - 1.4% per year in 1990 and 1.9% thereafter.

Waterborne primary metal imports grow somewhat faster to 1990 (3.1% per year), based on strong growth in coke imports in the late 1970s and early 1980s. Thus, while iron and steel product imports are increasing at 1.4% per year from 1977 to 1990 (17.5 million tons to 20.9 million tons) and other primary metal imports are growing at 5.4% per year, coke imports increase from 2.1 million tons to 6.6 million tons.

Finally, primary metals exports (2.8 million tons in 1977) remain relatively flat throughout the forecast period (reaching 3.1 million tons in 2003), a path followed by all three components.

(b) Major Market Shifts

All notable market shifts have been described in preceding sections. A shift in relative growth rates for finished steel mill products away from imports and toward domestic mills alters the river origination pattern for that commodity, but strong growth of import activity in ferroalloys and subsequent inland barge distribution activity sustains metals originations on the Lower Mississippi River. The rapid growth of this ferroalloy traffic, combined with flat intra-segment traffic in steel producing areas, reinforces a South-to-North domestic waterborne distribution pattern for the primary metals group as a whole.

Rapid growth of coke imports in the 1977-1990 period also buoys waterborne imports activity for the group as a whole, as the steel import growth rate slackens.

(c) Waterborne Flow Changes

Tables XIII-2 through XIII-5 present the waterborne demand projections for primary metals. Table XIII-2 shows

the domestic shipments and receipts for each of 21 report segments. Table XIII-3 presents the domestic tonnage utilizing each segment within the Mississippi River system and Great Lakes, including inbound, outbound, local, and through traffic. No total is presented in this table because of the implicit double-counting of flows utilizing more than one segment. Table XIII-4 exhibits the ton-miles generated on each segment for the traffic loading represented in the previous table. Ton-miles in 1977 may differ from data published elsewhere due to the level of aggregation of the NWS network used to generate distances. Projected ton-mile growth rates should be unaffected. Finally, Table XIII-5 shows the projected primary metals import-export activity for each NWS segment.

The fastest growing domestic originating segments are the Lower Mississippi River and Warrior River system (3.2% and 3.4% per year, respectively), which are dominated by growth in the distribution of import and locally produced ferroalloys. For the same reason (i.e., ferroalloys), steel-producing regions upriver show faster-than-average growth in primary metals receipts (e.g., 2.7% per year for the Ohio River system, and 1.9% on the Illinois). Primary metals traffic on all of these steel producing segments is also inhibited by the stagnation of intra-segment flows of iron and steel. For example, waterborne iron and steel originations on the Illinois River (including Calumet River plants) grows at 1.9% from 1977 to 1990, compared to 2.3% per year for outbound steel product shipments. West Coast segments show declining activity in domestic primary metal activity due to the elimination of domestic waterborne steel distribution in that area. This also explains some of the drop in Mid Atlantic shipments indicating the continued decline of Atlantic-to-Pacific flows.

Primary metals imports show different rates of growth on different segments in the forecast period depending primarily on commodity mix. Segments with large coke and/or ferroalloy components grow relatively fast in the 1977-1990 period - Baton Rouge to Gulf (40% per year) and Middle Atlantic Coast (4.4% per year), while ports for which the import commodity mix is weighted toward steel products grow more slowly - North Atlantic Coast (2.4% per year). Great Lakes import growth (2.7% per year from 1977-1990) suffers from a shift toward land-delivered Canadian sources for imports.

Table XIII-2

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY Primary Metals Products
ALTERNATIVE TrendLong2003A

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Shipped	62	63	64	65	67	68	70	0.4	0.5
	Received	294	292	343	380	411	446	468	2.0	1.6
Lower Upper Mississippi	Shipped	180	184	206	227	248	273	290	1.8	1.9
	Received	510	508	603	672	733	803	848	2.2	1.8
Lower Mississippi	Shipped	37	37	39	41	43	46	47	0.9	1.0
	Received	538	527	655	741	811	886	931	2.5	1.8
Baton Rouge to Gulf	Shipped	2,596	2,546	3,352	3,900	4,359	4,842	5,136	3.2	2.1
	Received	386	397	387	399	419	444	462	0.2	1.1
Illinois River	Shipped	813	825	887	946	1,005	1,075	1,122	1.2	1.3
	Received	1,126	1,118	1,305	1,436	1,549	1,668	1,742	1.9	1.5
Missouri River	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	77	75	93	104	113	122	128	2.3	1.6
Ohio River	Shipped	1,998	2,043	2,309	2,551	2,788	3,070	3,259	1.9	1.9
	Received	1,980	2,024	2,441	2,784	3,108	3,475	3,714	2.7	2.2
Tennessee River	Shipped	149	149	152	155	158	161	163	0.3	0.4
	Received	333	340	392	437	480	529	561	2.1	1.9
Arkansas River	Shipped	4	4	5	5	5	5	5	0.7	1.0
	Received	340	334	402	448	485	524	548	2.1	1.6
Gulf Coast West	Shipped	797	805	847	886	924	970	1,001	0.8	0.9
	Received	1,507	1,510	1,726	1,893	2,051	2,236	2,358	1.8	1.7
Gulf Coast East	Shipped	107	116	140	164	191	222	243	3.4	3.1
	Received	58	58	68	76	82	90	95	2.1	1.8
Warrior River System	Shipped	104	105	112	119	126	134	139	1.1	1.2
	Received	167	163	192	211	224	238	245	1.8	1.2
South Atlantic Coast	Shipped	125	125	125	125	125	125	125	0.0	0.0
	Received	76	76	76	76	76	76	76	0.0	0.0
Middle Atlantic Coast	Shipped	614	584	573	561	550	538	531	0.7	0.4
	Received	551	468	456	445	431	422	415	1.7	0.5

Table XIII-2 (continued)

SEGMENT	IN/OUT	YEARS 1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Shipped	13	13	13	13	13	13	13	0.0	0.0
	Received	4	4	4	4	4	4	4	0.0	0.0
Great Lakes and Seaway	Shipped	1,246	1,262	1,326	1,392	1,459	1,539	1,594	0.9	1.0
	Received	758	754	810	847	879	913	934	0.9	0.7
Washington/Oregon Coast	Shipped	173	79	79	79	79	79	79	-5.8	0.0
	Received	36	20	20	20	20	20	20	-4.4	0.0
Columbia Snake Willamette River	Shipped	11	10	10	10	10	10	10	-1.0	0.0
	Received	1	0	0	0	0	0	0	-100.0	0.0
California Coast	Shipped	70	70	70	70	70	70	70	0.0	0.0
	Received	32	8	8	8	8	8	8	-9.9	0.0
Alaska	Shipped	4	4	4	4	4	4	4	-1.6	0.0
	Received	63	63	63	63	63	63	63	0.0	0.0
Hawaii and Pacific Territories	Shipped	12	11	11	11	11	11	11	-0.3	0.0
	Received	96	96	96	96	96	96	96	0.0	0.0
Domestic Caribbean	Shipped	12	12	12	12	12	12	12	0.0	0.0
	Received	191	192	196	199	202	207	210	0.3	0.4
Total	Shipped	9,127	9,049	10,335	11,337	12,247	13,269	13,926	1.7	1.6
	Received	9,127	9,049	10,335	11,337	12,247	13,269	13,926	1.7	1.6

< - less than 500 tons

Table XIII-3

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL, AND THROUGH

COMMODITY Primary Metals Products
ALTERNATIVE Trendlong2003A

SEGMENT	YEARS 1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	356	355	407	445	478	514	538	1.7	1.5
Lower Upper Mississippi	2,689	2,699	3,206	3,597	3,951	4,348	4,603	2.3	1.9
Lower Mississippi	4,214	4,228	5,172	5,890	6,532	7,241	7,691	2.6	2.1
Baton Rouge to Gulf	4,060	4,054	5,003	5,707	6,328	7,007	7,432	2.7	2.1
Illinois River	2,410	2,427	2,795	3,089	3,358	3,663	3,859	1.9	1.7
Missouri River	77	75	93	104	113	122	128	2.3	1.6
Ohio River	3,518	3,598	4,228	4,765	5,280	5,872	6,262	2.4	2.1
Tennessee River	479	486	542	589	635	687	722	1.6	1.6
Arkansas River	342	336	404	450	488	527	551	2.1	1.6
Gulf Coast West	1,752	1,778	1,987	2,167	2,339	2,540	2,674	1.6	1.6
Gulf Coast East	314	320	387	442	493	551	589	2.7	2.2
Warrior River System	227	224	261	286	306	328	341	1.8	1.4
Great Lakes	1,457	1,469	1,589	1,692	1,791	1,905	1,981	1.2	1.2

a = less than 500 tons

Table XIII-4

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON MILES
MISSISSIPPI RIVER SYSTEM-GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY Primary Metals Products
ALTERNATIVE Trendlong2003A

SEGMENT	YEARS 1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	179	178	204	224	240	259	270	1.7	1.5
Lower Upper Mississippi	526	528	630	709	779	859	910	2.3	1.9
Lower Mississippi	2,554	2,569	3,147	3,593	3,995	4,441	4,724	2.7	2.1
Baton Rouge to Gulf	636	625	777	883	971	1,065	1,122	2.6	1.9
Illinois River	442	447	518	577	631	694	734	2.1	1.9
Missouri River	30	30	36	41	44	48	50	2.3	1.6
Ohio River	2,160	2,233	2,644	3,011	3,373	3,793	4,073	2.6	2.4
Tennessee River	120	121	141	157	172	190	201	2.1	1.9
Arkansas River	106	104	125	139	150	163	170	2.1	1.6
Gulf Coast West	323	330	376	416	455	501	531	2.0	1.9
Gulf Coast East	26	26	32	35	39	42	44	2.3	1.7
Warrior River System	35	34	38	41	43	45	46	1.2	1.0
Great Lakes	266	266	266	266	266	266	266	0.0	0.0
Total	7,403	7,491	8,935	10,091	11,159	12,364	13,142	2.4	2.1

a = less than 500,000 ton-miles

Table XIII-5

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY: Primary Metals Products
ALTERNATIVE: TrendLong2003A

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	371	367	319	317	329	348	363	-1.2	1.0
	Imports	3,623	3,756	5,165	6,011	6,739	7,549	8,049	4.0	2.3
Illinois River	Exports	139	178	171	170	172	175	177	1.6	0.3
	Imports	1,909	1,241	1,676	1,843	1,947	2,050	2,095	-0.3	1.0
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	328	317	266	263	276	296	312	-1.7	1.3
	Imports	2,542	2,331	3,143	3,595	3,899	4,183	4,327	2.7	1.4
Gulf Coast East	Exports	109	105	84	83	88	96	103	2.1	1.6
	Imports	324	312	410	476	528	570	609	3.0	1.9
Warrior River System	Exports	67	64	52	51	54	59	63	2.0	1.6
	Imports	201	187	255	295	325	356	373	3.0	1.8
South Atlantic Coast	Exports	240	272	232	230	240	256	269	-0.3	1.2
	Imports	902	774	1,024	1,158	1,243	1,317	1,351	1.9	1.2
Middle Atlantic Coast	Exports	1,036	1,195	1,066	1,059	1,091	1,142	1,183	0.2	0.9
	Imports	3,648	4,175	5,787	6,389	6,868	7,426	7,733	4.4	1.5

Table XIII-5 (continued)

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Exports	22	23	22	22	22	23	23	0.1	0.3
	Imports	752	659	898	1,029	1,118	1,205	1,250	2.4	1.5
Great Lakes and Seaway	Exports	256	344	323	322	327	335	342	1.8	0.5
	Imports	4,841	4,664	6,420	6,822	7,117	7,504	7,693	.7	0.9
Washington/Oregon Coast	Exports	72	80	76	75	76	78	79	0.4	0.4
	Imports	307	305	414	474	516	555	576	3.4	1.5
Columbia Snake Willamette River	Exports	18	22	20	20	20	21	22	0.7	0.6
	Imports	501	491	656	742	794	836	852	3.1	1.1
California Coast	Exports	117	175	146	145	152	164	173	1.6	1.4
	Imports	2,597	2,561	3,440	3,916	4,219	4,486	4,608	3.2	1.3
Alaska	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	19	20	26	29	30	30	30	3.1	0.3
Hawaii and Pacific Territories	Exports	a	a	a	a	a	a	a	0.8	1.2
	Imports	74	78	100	109	113	115	114	3.1	0.3
Domestic Caribbean	Exports	12	13	11	11	11	12	13	0.8	1.3
	Imports	173	182	237	260	270	277	278	3.2	0.5
Total	Exports	2,788	3,155	2,789	2,769	2,860	3,005	3,120	-0.1	0.9
	Imports	22,412	21,736	29,651	33,147	35,726	38,474	39,938	3.1	1.4

a = less than 500 tons

Chicago District grows by 72% (from 15.6 millions in 1977 to 26.8 million tons in 2003), while scrap compsumption in the Southern district grows by only 25% over the same period (from 9.5 to 11.8 million tons). The slower growth of Southern scrap consumption results from relatively faster growth in direct reduced iron usage. Scrap requirements are lower under both macroeconomic alternatives than in the Trendlong case, because slower growth in the economy causes less steel demand and slower electric furnace development. In 2003, scrap requirements fall short of Trendlong by 7 and 9 million tons for Badenergy and Largergovt, respectively.

Non-ferrous scrap imports are expected to continue their strong growth, but at a more moderate 5% per year rate, reaching 2 million tons in 2003. Non-ferrous scrap exports grow at about 2.7% per year over the forecast period, reaching 655 thousand tons in 2003.

2. Other Waste and Scrap. Other waste and scrap exports are expected to continue their strong growth, but at a more modest 3.7% per year (about half the historic rate). Although population-based waste is almost certain to grow at least as rapidly as the population in the future, environmental restrictions are likely to hinder waterborne transportation-related activity, which is largely for sludge and garbage dumping.

(c) Key Industry Changes

Scrap supply is a critical factor in any long-term projection of steel quantities. It is the dominant input for the electric furnace, which has to provide the bulk of steel capacity expansion in light of its low capital cost relative to the blast furnace-blast oxygen furnace combination.

In the face of this potential increase in demand, there is a strong tendency toward tighter supply. Home scrap as a proportion of raw steel plus castings is projected to decline substantially as a result of increased use of continuous casting. Prompt industrial scrap is projected to hold steady or decline as a proportion of steel consumption due to the potential for increased

The import basis of domestic primary metals growth is also demonstrated by Tables XIII-3 and XIII-4, which show strongest growth (2.6%-2.7% per year ton-mile growth to 1990) for the Lower Mississippi and Ohio River segments which play the biggest role in import distribution.

XIV - WASTE AND SCRAP

INDUSTRY OUTLOOK

Waste and scrap consists of two generic components - industrial, which is derived from and destined as an input to commercial activity (e.g., metal scrap and paper waste and scrap) and population-generated garbage and sewer sludge. Iron and steel scrap activity is forecast for the NWS based on domestic steel production, the technology mix of steel furnaces, and relative raw material costs. Other industrial waste and scrap is related to activity measures in producing and consumering industries. Population-based waste is assumed to be related to population levels.

(a) Industry Background

1. Metallic Scrap. Iron and steel scrap enters the steel production process as an input to the blast furnace for the production of pig iron (an intermediate step on the way to raw steel in the open hearth and basic oxygen technologies) or as a direct charge to the steel furnace (scrap provides nearly all of the metallic input to electric furnaces). Iron and steel scrap has two main sources: home scrap, which is generated within the steel mill from trimmings and obsolete equipment, and purchased scrap, which is derived from outside sources such as vehicle and machinery salvage. Of the 91.4 million tons of scrap available for consumption at consuming plants in 1977, 49.5 million were produced with the plant, and 41.9 million tons were purchased. The scrap requirements per ton of raw steel produced have been relatively constant over the last decade in spite of the growth in electric furnace share because of the decline in open hearth production which uses 67% more scrap than the basic oxygen process. Large volumes of United States iron and steel scrap are also exported (5.9 million tons in 1977).

Scrap purchases in non-ferrous metals industries are on a much smaller scale. For example, 1.9 million tons of aluminum scrap were received by aluminum producers

in 1977. Waterborne imports of non-ferrous metal scrap amounted to 403.5 thousand tons in 1977, up from 183.2 thousand tons in 1970. Non-ferrous scrap exports reached a peak of 381 thousand tons in 1973, before falling back to 328 thousand tons in 1977.

(b) National and Regional Forecasts

1. Metallic Scrap. Consumption of scrap is projected to increase from 91.9 million net tons in 1977 to 133.6 million net tons in 2003. This is an increase of 41.7 million tons, or 45%. An addtional million tons is added to user inventory over the period for a total increase of 42.7 million tons (Table XIV). The forecast increase in scrap consumption is less than would be indicated by the projected change in raw steel production and furnace mix if historical scrap usage ratios were to obtain.

The difference is due to a projected increase in the use of direct reduced iron from 348 thousand tons in 1978 (and prior 1974 peak of 614 thousand tons) to 44 million tons in 2003. The direct reduced iron would be used primarily as sponge iron in the electric furnace, but potentially in the blast furnace as well to increase productivity and reduce the coke rate.

Net exports of scrap are projected to rise from 8.2 million net tons in 1978 to 10.4 million by 1984. The projection is maintained at this level throughout the rest of the forecast period, on the assumption either that sufficient quantities of direct reduced iron are produced and consumed abroad to substitute for scrap in support of increased steel production, or controls are imposed on exports of United States scrap. Controls were imposed in 1973 when net scrap exports totaled 10.8 million tons and scrap prices reach levels comparable in real terms to those reached in 1984 under the Trendlong alternative.

Scrap consumption growth rates are expected to vary by region because of differential raw steel production growth and furnace shifts during the forecast period. For example, estimated scrap consumption in the

Table XIV-1
METALLIC SCRAP OUTLOOK
(Million's Of Short Tons)
Scenario Trendlong2003A

	1977	1980	1985	1990	1995	2000	2003	% GROWTH 77 TO 90	% GROWTH 90 TO 2003
UNITED STATES									
Raw Steel Production	124.7	130.4	149.8	165.9	180.4	196.1	206.4	2.2	1.7
%Electric Furnace	21.9	24.2	26.8	33.9	38.4	40.4	42.3	3.4	1.7
%Basic Oxygen	62.1	67.5	63.4	60.2	57.5	55.7	54.7	0.2	0.7
%Open Hearth	16.1	8.2	9.9	5.9	4.1	3.9	3.0	-7.4	-5.0
Scrap Consumption	91.9	91.3	108.1	119.0	125.0	130.5	133.6	2.0	0.9
Net Scrap Exports	5.2	8.2	10.4	10.4	10.4	10.4	10.4	5.4	0.0
REGIONAL SCRAP REQUIREMENTS									
BUFFALO	2.1	1.8	2.1	2.3	2.4	2.6	2.8	0.8	1.6
CHICAGO	15.6	16.9	20.1	23.0	24.4	25.9	26.8	3.0	1.2
CINCINNATI	3.1	2.9	4.1	4.7	4.8	4.9	5.0	3.3	0.6
DETROIT	4.9	5.6	6.3	6.9	7.4	7.9	8.3	2.7	1.4
NORTHEAST	9.0	8.7	10.9	11.1	11.3	11.5	11.0	1.6	0.0
PITTSBURGH	12.9	13.0	15.2	17.1	18.7	19.4	19.9	2.2	1.2
SOUTHERN	9.5	9.9	11.4	12.3	11.9	11.8	11.8	2.0	0.3
ST. LOUIS	3.1	3.4	3.7	4.0	4.0	4.0	4.1	1.9	0.1
WESTERN	5.1	5.3	6.3	6.6	7.2	7.4	7.4	2.0	0.8
YOUNGSTOWN	6.6	5.8	6.7	7.2	7.1	7.1	7.1	0.7	0.1

efficiency of materials use in end markets, leaving obsolete scrap as a residual supply to fill the gap.

There is no comonly accepted measure of usable obsolete scrap that would be available at any particular time from accumulated past steel consumption. However, estimates indicate that scrap prices would have to rise very substantially to call forth sufficient obsolete tonnage to fill the gap. By the mid-1980s, the pressure of rising demand on tightening supplies pushes the constant-dollar scrap price to the level of cost estimated for direct reduced iron.

As noted elsewhere in this report, direct reduced iron is likely to be developed in response to the scrap price and availability problems. While there are likely to be temporary short-term fluctuations whose precise timing and magnitude cannot be determined in the context of a trend macroeconomic forecast, the cost of the direct reduced iron substitute puts a ceiling on the long-term price of scrap. The NWS projections substitute direct reduced iron to fill the growing gap between scrap demand and supply at a constant-dollar price of approximately $110 per ton, which is the currently estimated cost of direct reduced iron. Alternative steel industry forecasts based on a higher production cost of direct reduced iron ($130/ton) have been developed for inclusion in the ten NWS scenarios.

DISTRIBUTION SYSTEM

The distribution system analysis for waste and scrap focused on the role of waterborne transportation in the iron and steel scrap delivery system as well as historic and expected trends in waterborne scrap delivery.

(a) Role of Waterborne Transportation

1. Metallic Scrap. The largest component of waterborne traffic of iron and steel scrap is exports, which amounted to 5.2 million tons in 1977, down from a

peak of 9.4 million tons in 1973. The largest export areas are the Atlantic Coast (50%-55% of total exports throughout the 1970s), which accesses the scrap pool in the Northeast population and industrial centers, and the Pacific Coast (32.4% in 1977, up from 27%-28% in earlier years), which services Far Eastern scrap markets.

Although some scrap arrives at many riverside steel plants by barge, the waterways are a minor source of scrap for most. The 1.5 to 2.3 million tons of metal scrap moving in domestic waterborne commerce since 1969 have amounted to about 2% of total consumption at consuming plants. These percentages should be discounted somewhat because some of the domestic scrap traffic is in support of United States scrap exports, a significant fraction of which occur from barge-served ports such as New Orleans, Mobile, and Chicago.

A significant share of domestic waterborne scrap traffic is in conjunction with foreign trade movements. For example, the substantial local tonnage within the New York harbor area (458 thousand tons - 25% of domestic scrap traffic) appears to be related to export activity in that area.

Other commercial waste and scrap is almost entirely foreign trade related. For example, 733 out of 788 thousand tons of non-ferrous scrap were waterborne imports or exports in 1977, and only 49 thousand out of 1.4 million tons of waterborne traffic for paper and textile waste and scrap was domestic traffic in that year.

The remaining waste and scrap traffic relates to refuse and sludge disposal in major urban areas such as New York (8.1 million tons in 1977, down from 11.0 millions tons in 1973) and Chicago (632 thousand tons in 1977, down from 3.7 million in 1975.

(b) Factors Affecting Modal Choice

As noted above, aside from import/export traffic, where the choice of mode is obvious, only a very small

share of scrap traffic utilizes waterborne transportation. The reasons for this parallel the modal choice factors outlined in the discussion of modal choice for steel mill products in the previous Chapter. Factors such as large minimum shipment sizes, loading and unloading costs (including movement within plant confines), and low speed all work against choice of barge. For example, the dispersion of scrap-generating activity (for all except home scrap) discourages the supply concentrations necessary for most efficient barge transportation. In fact, where barge transportation has made inroads into scrap traffic it is often for traffic between surplus and deficit steel plants which have a concentration of supply and demand as well as the facilities to load and unload barges. The time penalty also works against barge in a market as volatile as scrap markets.

(c) Distribution System Changes

The structure of waterborne scrap markets has been changing in recent years in response to changes in the steel industry. Growth of scrap-based steel capacity at Houston in the 1970s has made the Houston Ship Channel the largest scrap destination on the waterway system, with receipts growing from 11 thousand tons in 1970 to 450 thousand tons in 1977, with much of this growth being supported by increased shipments from the Warrior River System. At the same time, the growth of scrap-based minimills outside of traditional steel producing areas has reduced local surpluses previously available for possible barge transport on segments such as the Upper Mississippi River, the Upper Lower Mississippi River, and the Middle Ohio River.

As domestic scrap demand grows, United States producers will probably continue to bid scrap away from the export market - exports of 5.2 million tons in 1977 were down from 8-9 million tons at the beginning of the decade. To the extent that the export market has been delivered by barge to Gulf or Great Lakes ports, this will act to the detriment of waterways flows. However, since significant scrap-based furnace capacity has been installed at waterfront sites, such as Houston and Kansas City, much of the shift will be in destination rather than mode. For

example, a new barge dock will supply a significant fraction of the scrap requirements at an electric furnace facility in scrap-deficient Kansas City. Similarly, another steel producer is said to be implementing plans to load more scrap along the Mississippi River between St. Louis and Baton Rouge - an area with minimal steel-based scrap demand which has historically served the export scrap market.

WATERBORNE DEMAND PROJECTIONS

Projections of the demand for waterborne transportation of waste and scrap are built up from separate projections for metal scrap and other scrap. Domestic metal scrap flows, of which only the iron and steel component moves in any volume in domestic waterborne commerce, are projected on the basis of segment-specific export activity for inland flows oriented to export facilities, and on the basis of scrap consumption in river-oriented steel producing districts. The domestic component of "other" scrap transportation demand, which generally represents trash and sludge disposal, is expected to decline because of environmental limitations on dumping.

(a) Summary

The demand for domestic waterborne transportation of waste and scrap is flat between 1977 and 1990, and actually declines slightly from 14.3 million tons in 1990 to 13.9 million tons (-.2% per year). The projections reflect growth in waterborne metal scrap demand of 3.1% per year in the earlier period (2.0 million tons to 3.0 million tons), offset by slow declines in "other" scrap demand (-.7% per year). Metal scrap slows to .4% per year growth after 1990, while "other" scrap continues declining at .3% per year, reaching 10.8 million tons in 2003 (down from 12.4 million tons in 1977).

Waterborne scrap exports are projected to grow from 6.8 million tons in 1977 to 11.7 million tons in 1990 (4.2% per year), largely on the basis of a surge in metal scrap exports in the early part of the period. The slow

(1% per year) growth of scrap exports after 1990 results from moderate growth in non-ferrous and other scrap products (2.7%-3.7% per year) and flatness in the much larger iron and steel scrap exports.

The smaller waterborne scrap imports are projected to grow at 4.5%-5.0% throughout the forecast period, reaching 2.1 million tons in 2003. The demand for domestic waterborne scrap transportation is lower under both macroeconomic alternatives due to slower growth in scrap consumption by the domestic steel industry.

(b) Major Market Shifts

All notable shifts in waterborne scrap markets are documented elsewhere above. These include the limitation of scrap export growth and the relatively slow growth of Southern scrap requirements, which shift the market share of waterborne scrap terminations upriver on the Mississippi River system, and the development of new scrap receiving facilities at Kansas City. The decline of "other" scrap movements for dumping of trash and sludge also shows up as reductions in waste and scrap traffic in specific segments (e.g., New York and the Illinois River).

(c) Waterborne Flow Changes

Tables XIV-2 through XIV-5 present the waterborne demand projections for metallic ores. Table XIV-2 shows the domestic shipments and receipts for each of 21 report segments. Table XIV-3 presents the domestic tonnage utilizing each segment within the Mississippi River system and Great Lakes, including inbound, outbound, local, and through traffic. No total is presented in this table because of the implicit double-counting of flows utilizing more than one segment. Table XIV-4 exhibit the ton-miles generated on each segment for the traffic loading represented in the previous table. Ton-miles in 1977 may differ from data published elsewhere due to the level of aggregation of the NWS network used to generate distances. Projected ton-mile growth rates should be unaffected. Finally, Table XIV-5 shows the projected metallic ore import-export activity for each NWS segment.

Table XIV-2

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY Waste and Scrap
ALTERNATIVE Trendlong2003A

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77 90	90 03
Upper Mississippi	Shipped	33	36	41	46	46	46	47	2.6	0.2
	Received	2	2	2	2	2	2	3	2.0	0.9
Lower Upper Mississippi	Shipped	68	71	81	91	94	97	99	2.2	0.7
	Received	134	143	159	172	171	173	175	1.9	0.1
Lower Mississippi	Shipped	72	77	90	100	103	104	106	2.6	0.4
	Received	38	33	29	25	22	19	18	-3.2	-2.4
Baton Rouge to Gulf	Shipped	139	135	134	134	126	121	119	-0.3	-0.9
	Received	111	102	99	96	92	89	88	-1.1	-0.6
Illinois River	Shipped	985	928	885	858	808	774	762	-1.1	-0.9
	Received	795	729	659	610	560	527	514	-2.0	-1.3
Missouri River	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	8	37	74	111	111	112	112	22.2	0.1
Ohio River	Shipped	241	253	300	341	366	378	387	2.7	1.0
	Received	276	275	315	348	379	390	399	1.8	1.1
Tennessee River	Shipped	56	55	58	61	61	61	61	0.6	0.0
	Received	38	37	44	49	51	53	55	2.0	0.9
Arkansas River	Shipped	20	21	26	29	30	31	32	3.1	0.6
	Received	1	1	2	2	2	2	2	2.0	0.9
Gulf Coast West	Shipped	830	721	580	469	381	312	279	-4.3	-3.9
	Received	1,354	1,258	1,177	1,102	988	905	869	-1.6	-1.8
Gulf Coast East	Shipped	67	69	78	83	81	80	80	1.7	0.3
	Received	14	14	15	16	15	15	15	0.9	-0.6
Warrior River System	Shipped	374	390	448	483	471	466	466	2.0	-0.3
	Received	25	26	30	32	31	31	31	2.0	0.3
South Atlantic Coast	Shipped	32	34	40	42	42	42	41	2.0	-0.1
	Received	55	57	65	71	69	68	68	2.0	0.3
Middle Atlantic Coast	Shipped	9,057	9,130	9,384	9,402	9,421	9,437	9,406	0.3	0.0
	Received	9,101	9,184	9,476	9,493	9,517	9,536	9,500	0.3	0.0

Table XIV-2 (continued)

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Shipped	54	64	97	100	102	104	100	4.8	0.1
	Received	7	7	7	7	7	7	7	0.0	0.0
Great Lakes and Seaway	Shipped	116	121	136	148	153	159	163	1.9	0.8
	Received	204	217	251	280	294	309	319	2.5	1.0
Washington/Oregon Coast	Shipped	1,836	1,754	1,642	1,555	1,487	1,435	1,410	-1.3	0.7
	Received	1,873	1,790	1,678	1,591	1,523	1,471	1,446	-1.2	-0.7
Columbia Snake Willamette River	Shipped	59	50	39	30	24	18	16	-4.9	4.9
	Received	59	51	39	31	24	19	16	-4.9	4.8
California Coast	Shipped	12	12	14	14	14	14	14	1.3	0.0
	Received	26	26	26	26	26	26	26	0.0	0.0
Alaska	Shipped	26	26	26	26	26	26	26	0.0	0.0
	Received	2	2	2	2	2	2	2	0.0	0.0
Hawaii and Pacific Territories	Shipped	34	34	34	34	34	34	34	0.0	0.0
	Received	8	8	8	8	8	8	8	0.0	0.0
Domestic Caribbean	Shipped	221	226	230	230	230	231	230	0.3	0.0
	Received	202	205	205	205	205	205	205	0.1	0.0
Total	Shipped	14,333	14,207	14,363	14,276	14,100	13,972	13,879	0.0	-0.2
	Received	14,333	14,207	14,363	14,276	14,100	13,972	13,879	0.0	-0.2

a = less than 500 tons

Table XIV-3

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL, AND THROUGH
COMMODITY: Waste and Scrap
ALTERNATIVE: Trendlong2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	34	37	43	48	48	48	49	2.6	0.2
Lower Upper Mississippi	436	476	559	634	641	653	662	2.9	0.3
Lower Mississippi	325	325	349	368	364	362	364	0.9	0.1
Baton Rouge to Gulf	390	373	373	371	351	340	336	0.4	-0.8
Illinois River	1,129	1,082	1,068	1,068	1,029	1,008	1,004	0.4	0.5
Missouri River	8	37	74	111	111	112	112	22.2	0.1
Ohio River	397	408	476	533	569	586	599	2.3	0.9
Tennessee River	94	92	102	109	112	114	115	1.2	0.4
Arkansas River	20	21	25	29	30	31	32	3.1	0.6
Gulf Coast West	1,430	1,327	1,244	1,165	1,048	963	926	1.6	-1.8
Gulf Coast East	434	452	516	556	541	535	535	1.9	-0.3
Warrior River System	381	397	456	492	480	474	474	2.0	0.3
Great Lakes	242	257	298	333	350	368	379	2.5	1.0

a - less than 500 tons

Table XIV-4

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY: Waste and Scrap
ALTERNATIVE: Trendlong2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	16	18	20	23	23	23	23	2.6	0.2
Lower Upper Mississippi	70	73	84	93	94	95	97	2.2	0.3
Lower Mississippi	177	177	190	200	198	197	197	0.9	0.1
Baton Rouge to Gulf	53	51	52	52	50	49	49	0.1	-0.5
Illinois River	214	208	211	215	210	208	209	0.0	-0.2
Missouri River	3	14	27	40	41	41	41	22.2	0.1
Ohio River	262	268	314	352	381	394	403	2.3	1.0
Tennessee River	18	19	22	25	27	27	28	2.4	0.9
Arkansas River	5	6	7	8	8	8	8	3.1	0.6
Gulf Coast West	275	271	284	289	274	264	260	0.4	-0.8
Gulf Coast East	51	53	61	66	64	64	64	2.0	0.3
Warrior River System	136	142	163	176	171	169	169	2.0	-0.3
Great Lakes	48	51	59	66	69	73	75	2.5	1.0
Total	1,329	1,350	1,494	1,605	1,609	1,613	1,624	1.5	0.1

a = less than 500,000 ton miles

Table XIV-5

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY Waste and Scrap
ALTERNATIVE Trendlong2003A

SEGMENT	EXP/IMP	1977	* 1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77 90	% GROWTH 90 03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	265	351	443	448	454	462	466	4.1	0.3
	Imports	166	207	260	327	398	507	587	5.4	4.6
Illinois River	Exports	16	21	27	27	27	27	27	4.1	0.2
	Imports	7	8	11	13	16	21	24	5.4	4.6
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	100	127	162	174	189	206	217	4.4	1.7
	Imports	71	89	111	140	170	217	251	5.4	4.6
Gulf Coast East	Exports	142	186	235	242	250	260	267	4.2	0.7
	Imports	2	3	4	5	6	7	8	5.3	4.6
Warrior River System	Exports	43	57	72	73	75	78	79	4.2	0.6
	Imports	0	0	0	0	0	0	[illegible]	[illegible]	0.0
South Atlantic Coast	Exports	275	337	422	455	492	533	558	3.9	1.6
	Imports	54	65	79	97	115	144	165	4.5	4.2
Middle Atlantic Coast	Exports	2,232	2,90[illegible]	3,657	3,746	3,845	3,955	4,026	4.1	0.6
	Imports	141	171	210	259	310	389	447	4.8	4.3

Table XIV-5 (continued)

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic	Exports	975	1,286	1,622	1,642	1,664	1,689	1,706	4.1	0.3
Coast	Imports	9	10	10	10	10	10	10	0.1	0.1
Great Lakes and	Exports	288	382	482	485	489	493	495	4.1	0.2
Seaway	Imports	96	120	150	189	230	294	340	5.4	4.6
Washington/Oregon	Exports	240	304	396	444	503	576	628	4.3	2.7
Coast	Imports	29	37	46	57	70	89	102	5.3	4.5
Columbia Snake	Exports	200	262	333	346	361	379	391	4.3	1.0
Willamette River	Imports	a	a	a	a	a	a	a	2.1	2.4
California Coast	Exports	1,940	2,523	3,229	3,416	3,644	3,922	4,115	4.4	1.4
	Imports	50	60	72	88	105	131	150	4.5	4.2
Alaska	Exports	a	a	a	a	a	a	a	4.1	0.2
	Imports	7	7	7	7	7	7	7	0.1	0.0
Hawaii and Pacific	Exports	32	39	50	57	66	76	83	4.6	3.0
Territories	Imports	a	a	a	a	a	a	a	0.1	0.0
Domestic Caribbean	Exports	69	82	106	124	146	171	188	4.7	3.2
	Imports	1	2	2	3	3	4	5	5.0	4.4
Total	Exports	6,817	8,860	11,236	11,682	12,206	12,827	13,248	4.2	1.0
	Imports	634	779	962	1,196	1,439	1,820	2,097	5.0	4.4

a = less than 500 tons

Tables detailing projections for the macroeconomic alternatives are found in Appendix B.

The growth of demand for waterborne scrap transportation on particular segments depends on the commodity mix and market mix of the segment's traffic. Thus, although metal scrap terminations at the Houston Ship Channel grow 2.0% per year to 1990, reflecting growing requirements for iron and steel scrap to feed the Texas steel industry, total scrap receipts at the West Gulf as a whole decline 1.6% because of the dominance of declining "other" scrap receipts in that area. A similar phenomenon causes total scrap receipts on the Illinois River to decline 2.0% per year, even though metal scrap receipts are growing at 3.0% per year.

Domestic scrap receipts on most inland segments reflect the growth of scrap consumption in the steel producing regions served by them. Exceptions include the Missouri River, where metal scrap receipts grow at 22% between 1977 and 1990, reflecting the development of waterborne receiving facilities by the steel industry at Kansas City. 4.9% per year growth in metallic scrap export activity is masked by an offsetting decline in dumping activity there.

Originating shipment activity by segment is also a function of commodity and market mix. Thus, segments which serve the growing Missouri River market grow relatively faster than average from 1977 to 1990 (2.6%-2.7% per year for the Upper Mississippi and Ohio Rivers compared to 2.0% for the Warrior System).

Scrap traffic growth slows on all segments handling metal scrap traffic in the second half of the forecast period due to acceleration of the introduction of direct reduced iron as a feed for electric steel furnaces. For example, domestic ton-miles of waste and scrap traffic grow at 1.5% per year from 1977 to 1990, but only .1% per year thereafter.

XV - OTHER COMMODITIES

INDUSTRY OUTLOOK

As in the case of stone, clay, glass and concrete products, a variety of forecasting models were accessed in the projections of "other commodities" waterborne traffic demand. For example, marine shell projections were derived from industry sources, while the majority of miscellaneous commodity growth rates were developed from concepts forecast in the Macro Model of the United States Economy. Information of waterway improvement material flows was provided by the Corps of Engineers.

In general, regional adjustments to the forecasts were made at the specific commodity level. In particular, fresh fish and shellfish landings by coastal ranges were adjusted to reflect changes in the types of fish stocks exploited as well as environmental factors - such as pollution - that hinder catch levels.

(a) Industry Background

The NWS "other commodity" category consists of three major areas: marine shells, miscellaneous commodities (chiefly manufactured products), and waterway improvement materials.

Marine shells, mined in the Gulf of Mexico, Warrior River System and along the Gulf Intercoastal Waterway, have a variety of applications related to the construction industry - principally as highway roadbeds and as a source of lime. Material substitution over the past ten years has reduced the need for additional mining operations. In addition, increasing environmental restrictions on seabed mining activity have curtailed marine shell production along the Gulf Coast. Average marine shell production in the late 1970s has been just over 10 million tons per year. At present, no marine shells are imported to or exported from the United States.

Miscellaneous commodities in the NWS forecasting effort (see Appendix A for a complete list) consist primarily of lesser (in volume terms) manufactured products. Ranging from other forest products through rubber and fabricated metals to miscellaneous manufactures, these commodities are a residual category in the overall forecasting process. In 1977, miscellaneous commodity movements were just over 3% of total (domestic and foreign) waterborne traffic. Forecasts of these commodity groups generally involved using projections from the Macro Model of the United States Economy. Foreign trade was the major contributor to miscellaneous waterborne commodity traffic in the late 1970s.

Waterways improvement materials consist primarily of rock used in waterway bank stabilization, rock fill for lock and dam erosion containment as well as for channel improvements. Since future waterway improvements will be determined as an output of NWS, no forecasting model of this commodity was developed. Estimates of materials used are held at 1977 levels, except in cases where episodic (one-time) projects were known to be underway.

(b) National and Regional Forecasts

As previously mentioned, a variety of forecasting sources were used in developing miscellaneous commodity waterborne demand projections. In general, estimates of production and/or consumption for each specific industry (tobacco, for example) are produced for the forecast period and used to drive waterborne domestic and foreign traffic for each miscellaneous commodity. The results of the analysis are presented in Table XV-1.

Overall, total United States industrial production is expected to grow by just over 3.5% per year from 1980 to 2003 under the Trendlong scenario. Growth by industry sector varies from a low of just over 1% per year for tobacco products to over 5% per year for the rubber and plastics sectors.

Export growth is expected to be quite bullish over the next twenty-five years, with average yearly rates and

increase at well over 5% for most categories. Automotive and truck related exports are forecast to be quite strong as the United States begins marketing parts and components for "world-vehicles" abroad.

Import trade is likely to increase at a somewhat slower rate than exports in the 1980 to 2003 period. Declines in automotive imports reflect the location of foreign producers within the United States in response to calls for auto import protection by Detroit.

Domestic fish consumption is expected to grow in relation to historical rates during the forecast period, averaging 1.9% per year to 1990 and 1.6% per year through 2003. Per capita fish consumption in the United States has been assumed to increase by about 1% per year over the next twenty-five years.

Finally, marine shell production in the Gulf Coast region is expected to decline by 1.0% per year throughout the forecast period.

Regional forecasts were generally not developed in the miscellaneous commodity analysis. Where they exist, specific discussion of the results are presented in the Waterborne Demand Projections section.

Miscellaneous commodity explanatory factor growth rates did not vary substantially under the alternative macroeconomic scenarios. For example, total United States industrial production averaged 3.5% under the Largergovt scenario and 3.4% under the Badenergy option relative to about 3.6% under Trendlong. The major reason is that the alternative scenarios were developed to affect bulk commodities (the major traffic on waterways) as opposed to manufactured product sectors.

(c) Key Industry Developments

In line with recent experience, a continuing decline has been forecast for marine shell traffic in the forecast

TABLE XV-I
National Waterways Study

Other Commodities
Explanatory Factors

Scenario - TRENDLONG2003A

	Years						% Growth		
	1977	1980	1985	1990	1995	2000	2003	77-90	90-03
Industrial Production Indexes (1967=1.00)									
Total	1.371	1.521	1.937	2.316	2.718	3.211	3.563	4.1	3.4
Tobacco Products	1.141	1.242	1.349	1.382	1.457	1.451	1.545	1.5	0.9
Apparel Products	1.241	1.344	1.653	1.892	2.133	2.398	2.579	3.3	2.4
Paints	1.085	1.169	1.342	1.594	1.941	2.221	2.362	3.0	3.1
Rubber & Plastics Products	2.321	2.741	4.048	5.273	6.816	8.901	10.421	6.5	5.4
Nonelectrical Machinery	1.448	1.688	2.284	2.895	3.570	4.417	5.026	5.5	4.3
Instruments	1.591	1.806	2.373	2.964	3.608	4.326	4.839	4.9	3.8
Miscellaneous Manufactures	1.491	1.636	2.287	2.762	3.219	3.824	4.301	4.9	3.5
Exports by End-Use Categories (Billions of 72$)									
Capital Goods, Ex. Automotive	18.3	22.0	31.1	41.1	54.3	72.3	86.2	6.4	5.9
Automotive Vehicles, Parts, Etc.	6.0	7.6	10.8	14.4	18.7	24.3	28.9	6.9	5.5

TABLE XVI (cont.)

	Years 1977	1980	1985	1990	1995	2000	2003	% Growth 77-90	90-03
Consumer Goods, Ex. Automotive	5.2	5.9	7.6	10.0	13.0	16.5	19.1	5.2	5.1
[illegible]orts [illegible] Merchan-[illegible]se - NIA Basis	68.2	80.6	107.0	135.6	171.0	216.0	249.3	5.4	4.8
Imports by End-Use Categories (Billions of 72$)									
Capital Goods, Ex. Automotive	6.9	8.3	11.2	15.2	19.1	23.7	26.9	6.3	4.5
Automotive Vehicles, Parts, Etc.	7.4	8.4	6.9	7.2	8.8	9.8	10.6	-0.2	3.0
Consumer Goods, Ex. Automotive	9.5	11.4	17.0	22.1	28.4	36.1	41.5	6.7	5.0
Imports of Merchandise - NIA Basis	70.4	78.6	101.0	123.2	149.6	181.0	203.0	4.4	3.9
Retail Sales of New Passenger Cars - Imports*	2.1	1.9	1.5	1.5	1.7	1.9	2.0	-2.2	1.8
Domestic United States Fish Consumption (1,000's of Tons)	1,523	1,562	1,872	1,956	2,282	2,350	2,389	1.9	1.6

*Millions of units.

period. The consensus in industry outlook has a general decline in production, with some slight increases for certain deposits. Stricter environmental regulations governing this activity will constrain both exploitation of new marine shell deposits as well as restrict existing activities. No technological changes in the industry are expected in the coming years that would influence shipment levels. The current forecast of a 1% per year decline in traffic appears optimistic, given the growing constraints on marine shell mining operations.

For fresh fish landings, the industry consensus forecast of 3.3% production growth over the next twenty-five years was used. This rate is consonant with catch levels and is not expected to deplete major food fish stocks below population reproduction levels. Substitution of new fish types is implicitly assumed in the forecast although exact species are unkown at present.

Current environmental problems will limit new production gorwth in shellfish to 5.0% per year. The shellfish catch is assumed to grow at 3.0% per year to 2003, given that shellfish farms are able to replace current pollution induced limits on seabed production. Menhaden fish catches are assumed to grow in line with United States paint production, since the fish is used as a source of oil for paint.

Fabricated metals and machinery traffic, generally determined by United States production activity in these sectors, was assumed to grow in line with the industry through 2003.

Motor vehicle traffic in the domestic trades was closely related to United States vehicle production and forecast on the basis of auto sector growth over the next twenty-five years. Foreign trade activity in motor vehicles was related both to other-than-United States demand for American cars and trucks as well as imported car demand in the United States. As stated earlier, car imports as a percent of total production are expected to stabilize in the 1980s and beyond as foreign manufacturers locate in the United States.

Miscellaneous commodity flows by water - both domestic and overseas trades - are expected to move inline with United States industrial production as well as import/export activity. Increasing imports of miscellaneous manufactured goods from United States subsidiaries in Southeast Asia in the forecast period account for substantial amount of United States foreign trade growth.

Water, with principal movements in support of oil and gas drilling activities (drilling mud and shaft lining production), is expected to grow inline with new exploration activity, especially offshore development. Historical growth rates of 8% per year in water consumption in this sector will decline slightly as more wells are drilled on-shore, necessitating transportation by other modes. Overall, offshore oil and gas well water demands are assumed to grow 5% per year in the next quarter century.

DISTRIBUTION SYSTEM

A formal anaylsis of the waterway distribution system for the "other commodities" groups was not undertaken in NWS. The following sections, however, summarize some of the key aspects of waterborne movements for these commodities.

(a) Role of Waterway Transportation

Marine shell traffic is concentrated in local and internal movements on the waterway system, with all other traffic classes neglibible or zero. Since 1965, shells traffic has fallen from a high of just over 19 million tons to 11 million tons in 1977. Local traffic has fallen even more dramatically, dropping from 8.5 million tons in 1965 to 1 million tons in 1977.

Marine shell mining has been concentrated along the Gulf Intercoastal Waterway, in the Gulf of Mexico and on the Warrior River System. Most traffic lost in recent years has been concentrated in the Gulf Intercoastal Waterway - West section. Barge is the only feasible mode for the majority of movements from seabed mining areas to land, with truck movements to final consumption site.

Although the miscellaneous commodity group encompasses a wide variety of products, waterborne traffic is concentrated in a relatively few categories. For miscellaneous internal traffic, three groups dominate: fish and shellfish (approximately 30% of 1977 traffic in the miscellaneous group), water (36% of 1977 traffic levels) and manufactured commodities (34% of 1977 traffic). In the coastwise trade, manufactured commodities (including unidentified commodities) make up almost all the traffic. For lakewise, trade, miscellaneous and unidentified manufactured products represent 55% of traffic with machinery at 20% of water traffic. Interterritorial traffic is composed of 45% unidentified commodities, 15% water, 15% furniture and much of the rest fresh fish. Finally, 64% of local traffic is water, 15% is unidentified, and the rest is fish.

Since "other" waterborne traffic by class tends to be concentrated in three basic areas - fresh fish, water and miscellaneous/unidentified manufacturers, discussion of distribution systems is limited to these commodities. Fresh fish has destinations concentrated in only a few NWS reporting segments - Central/Southern California, Chesapeake/Delaware bays, the Upper Atlantic and Puget Sound. Tuna and other commercial fishing accounts for the majority of fresh fish landings in California, with the Chesapeake Bay area a distant second in commercial fishing activity (both food and other fish landings). Shellfish traffic is located primarily along the Upper Atlantic Coast, from Chesapeake Bay north to Maine (72% of domestic terminations in 1977). Menhaden landings occur primarily along the East Coast of the United States.

Fabricated metals, machinery, motor vehicle and miscellaneous manufactures traffic have the great majority of their waterborne flows concentrated in import/export activity. Fabricated metals waterborne traffic is concentrated in Hawaii and along the Southern California coast. Machinery flows are primarily imports to the United States. Motor vehicles are generally strong in the import trades, although they make up 9% of coastwise waterborne activity. Miscellaenous manufactures make up 20% of internal miscellaneous traffic and 43% of miscellaneous lakewise flows. Almost all the internal flows originate in the lower Mississippi River (New Orleans to

Gulf) and along the Gulf Intercoastal Waterway. In general, these movements have grown rapidly in recent years.

Water movements have been concentrated along the Gulf Coast in the past as well as in the Chesapeake Bay/New York and New Jersey segments. Water makes up 36% of miscellaneous internal movements, 15% of interterritorial traffic, and 64% of miscellaneous flows. Gulf coast movements have tended to be quite stable with other areas highly variable over time.

(b) Factors Affecting Modal Choice

The "other commodities" group in NWS share the common attribute of having little, if any, model competition for most of their movements. Marine shells are generally mined in seabead deposits and must be moved by barge to shore. Fish, shellfish and water movements to drilling rigs cannot move by other modes. Miscellaneous and other manufactured products traffic by water are generally imports or exports, with the only major choice being port of debarkation or importation with regard to water movement.

In general, NWS did not deal with the question of relative port choice for United States import/export traffic. Where significant trends existed - such as the growth of Los Angeles in cotton exports - the forecasts reflected changing shares by coastal range in traffic. In addition, the strong growth in manufactured imports via West Coast relative to Gulf Coast ports - especially from Southeast Asia - was included in the analysis. Otherwise, only a few changes in mode or port choice among "other commodity" groups was attempted, primarily due to a lack of specific information on actual types of commodity flows via water (e.g., miscellaneous as one category).

(c) Distribution System Changes

No major shifts in distribution systems are expected of the "other commodities" products during the forecast

period. The typical change will be increases in relative fish landings on certain coastal areas, the growth of water movements in Chesapeake Bay to serve Baltimore Canyon oil and gas exploration sites, and the increase in manufactured imports via the West Coast. Since most of the "other commodity" flows by water are closely linked to their existing mode because of the nature of the movement and product, little risk is associated with assuming fairly constant model shares in the future.

WATERBORNE DEMAND PROJECTIONS

Translating national production and/or consumption forecasts of NWS "other" commodities into waterborne demand projections consisted of expanding 1977 waterway traffic levels of these commodities by segment origin - destination using indices of growth developed from industry and macroeconomic forecasts. Usually, model shares were held constant at the 1977 levels during the forecast period. In certain cases, where previous studies had revealed a possible model change or information from district offices was available, shifts were introduced.

Once the forecasting was complete at the analysis segment level, waterborne commodity flows were aggregated to reporting segment and commodities (see Appendix A for regional and commodity definitions). After the basic expansion and aggregation of the 1977 waterborne flows by miscellaneous commodity groups was completed for each of the three NWS macro economic scenarios, any additional or new flows were edited into the forecast data base.

(a) Summ.ry

Domestic waterborne traffic flows of "other commodities" are expected to grow at a substantially lower rate than foreign trade in these commodities over the forecast period, according to Tables XV-2 and XV-5. Domestic traffic, led basically by manufactured products, is likely to increase by just under 2% per year from 1977 to 2003, while imports of "other commodities" (led by miscellaneous manufactures) are forecast to grow 3.8% per year and exports by 5.7%.

For domestic trades, coastwise movements of manufacturers - closely related to foreign trade activity - experience the strongest growth. All three coasts - Atlantic, Pacific, and Gulf - have similar growth rates over the forecast period. In foreign trade, the major tonnage growth is expected in the Middle Atlantic and California Coasts for "other commodity" waterborne traffic.

Miscellaneous manufactured commodity movements along the Gulf Coast West cause the largest increase in total waterborne traffic activity by segment over the next twenty-five years, according to Table XV-3. Total "other commodity" flows (including water, miscellaneous commodities and others) on the Gulf Coast West grows from 12.2 million tons in 1977 to 18.5 million in 2003 under the Trendlong scenario. Other waterways segments traffic in "other commodities" experience fairly slow (less than 1% growth) per year in the forecast period.

Domestic ton-mile estimates for "other commodities," presented in Table XV-4, contain similar growth patterns for traffic loadings in Table XV-3. Overall, total ton-mile growth will be just over one-half of one percent per year through 2003.

As mentioned earlier, alternative macroeconomic scenarios do not substantially alter "other commodity" waterborne demand projections in the forecast period. Appendix B contains "other commodity" waterborne demand projections tables for the Badenergy and Largergovt macroeconomic scenarios.

(b) Major Market Shifts

Growth in foreign trade activity in miscellaneous manufactured products along the East and West Coasts of the United States is the primary shift occuring in the "other commodity" category of waterborne traffic over the forecast period. The Gulf and Great Lakes will grow at the same rate as the other coasts, but start from a much smaller base. Thus, East and West Coast ports will grow relatively to the other costs in these commodity groups.

Coastwise movements along these costs will also arise in support of the growth of foreign trade activity. On a relative basis, coastwise domestic traffic in "other commodities" grows much faster than internal or other traffic classes through 2003.

The only other potential market shift of significance is the growth of water traffic to oil and gas drilling rigs off the Chesapeake Bay areas in the Baltimore Canyon.

As mentioned earlier, due to the nature of the transportation and commodities involved, little or no change in model traffic patterns for "other commodities" group relative to waterborne flows is expected.

(c) Waterborne Flow Development

Major tonnage growth in waterborne "other commodities" will occur in the foreign and related coastwise trades during the next quarter century. In particular, the Atlantic Coast as well as the Gulf Coast West experience strong domestic tonnage growth. For "other commodities" foreign trade, the Middle Atlantic and California Coasts have the large growth in import and export tonnages through 2003 under the Trendlong and other scenarios.

Due to the unknown nature of many of the commodity groups, no new flows were added to the data base for "other commodity" waterborne demand projections in the forecast period.

For similar reasons, assessing the risks of any "other commodity" flows via water is quite difficult. In general, "other commodities" moving in waterborne carriage are closely related to United States foreign trade activity. Thus, risks associated with this traffic would be oriented towards changes in United States trade policies and/or dollar exchange rates over the next twenty-five years. These two areas are quite difficult to predict with accuracy in any forecasting model. In general, continuation of existing trade relations is assumed, with a greater dependence on the Third World for United States trade a key growth factor in the next twenty-five years.

Table XV-2

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY: Other Commodities
ALTERNATIVE: Trendlong2003A

SEGMENT	IN/OUT	1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
Upper Mississippi	Shipped	37	37	38	40	41	42	43	0	0.7
	Received	151	151	152	153	155	157	158	[illegible]	0.2
Lower Upper Mississippi	Shipped	1,139	1,141	1,149	1,158	1,168	1,179	1,187	0.1	0.2
	Received	523	533	544	556	569	585	596	0.4	0.5
Lower Mississippi	Shipped	1,210	1,214	1,224	1,237	1,249	1,264	1,275	0.2	0.2
	Received	3,193	3,196	3,204	3,214	3,224	3,236	3,245	0.0	0.1
Baton Rouge to Gulf	Shipped	1,202	1,274	1,479	1,723	1,963	2,205	2,476	2.8	2.8
	Received	3,804	3,836	3,974	4,153	4,331	4,572	4,747	0.7	1.0
Illinois River	Shipped	22	24	30	36	42	50	56	3.8	3.4
	Received	55	60	74	90	105	125	139	3.8	3.4
Missouri River	Shipped	327	327	328	328	328	329	329	0.0	0.0
	Received	329	330	331	332	333	334	335	0.1	0.1
Ohio River	Shipped	1,880	1,894	1,933	1,980	2,026	2,083	2,124	0.4	0.5
	Received	506	519	554	597	639	692	729	1.3	1.5
Tennessee River	Shipped	1,572	1,576	1,587	1,599	1,612	1,628	1,639	0.1	0.2
	Received	82	88	104	123	142	166	182	3.2	3.1
Arkansas River	Shipped	634	635	636	639	641	644	646	0.1	0.1
	Received	692	693	697	702	706	712	716	0.1	0.2
Gulf Coast West	Shipped	10,391	10,670	11,657	12,889	14,113	15,723	16,874	1.7	2.1
	Received	11,821	12,058	12,976	14,141	15,302	16,852	17,969	1.4	1.9
Gulf Coast East	Shipped	5,648	5,526	5,355	5,208	5,081	4,930	4,954	-0.6	0.4
	Received	2,608	2,561	2,507	2,469	2,438	2,429	2,435	-0.4	-0.1
Warrior River System	Shipped	1,195	1,162	1,111	1,065	1,021	980	958	-0.9	-0.8
	Received	1,426	1,387	1,325	1,268	1,214	1,165	1,138	-0.9	-0.8
South Atlantic Coast	Shipped	646	746	921	1,118	1,357	1,649	1,861	4.3	4.0
	Received	413	478	589	715	868	1,055	1,191	4.3	4.0
Middle Atlantic Coast	Shipped	2,830	3,204	3,855	4,591	5,490	6,593	7,395	3.8	3.7
	Received	2,461	2,777	3,327	3,951	4,713	5,649	6,329	3.7	3.7

Table XV-2 (continued)

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Shipped	284	328	405	491	596	724	[illegible]	4.3	4.0
	Received	339	392	483	587	712	865	[illegible]	4.3	[illegible]
Great Lakes and Seaway	Shipped	247	255	302	335	367	411	447	2.4	2.2
	Received	254	263	311	346	380	426	464	2.4	2.3
Washington/Oregon Coast	Shipped	763	890	1,096	1,318	1,598	1,942	2,190	4.3	4.0
	Received	249	286	352	428	518	629	[illegible]	4.3	4.0
Columbia Snake Willamette River	Shipped	68	76	93	113	135	162	181	4.0	3.7
	Received	49	54	66	[illegible]	95	114	127	3.9	3.6
California Coast	Shipped	1,482	1,709	2,106	2,553	3,095	3,759	4,241	4.3	4.0
	Received	1,051	1,212	1,492	1,808	2,192	2,661	[illegible]	4.3	4.0
Alaska	Shipped	243	280	346	420	509	619	699	4.3	4.0
	Received	735	849	1,047	1,271	1,543	[illegible]	2,116	4.3	4.0
Hawaii and Pacific Territories	Shipped	1,025	1,184	1,461	1,774	2,153	2,616	2,953	4.3	4.0
	Received	1,595	1,844	2,275	2,761	3,351	4,073	4,597	4.3	4.0
Domestic [illegible]	Shipped	476	519	610	712	837	990	1,101	3.1	3.4
	Received	979	1,099	1,326	1,592	1,832	2,273	2,549	3.8	3.7
Total	Shipped	33,321	34,663	37,712	41,326	45,421	50,645	54,446	1.7	2.1
	Received	33,321	34,663	[illegible]	41,326	[illegible]	[illegible]	54,446	1.7	2.1

a = less than 500 tons

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Table XV-3

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL, AND THROUGH

COMMODITY Other Commodities
ALTERNATIVE TrendLong2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77 90	90 03
Upper Mississippi	153	154	155	157	160	163	165	0.2	0.3
Lower Upper Mississippi	1,253	1,264	1,296	1,333	1,370	1,417	1,450	0.5	0.6
Lower Mississippi	4,890	4,914	4,982	5,063	5,144	5,246	5,317	0.3	0.4
Baton Rouge to Gulf	4,143	4,194	4,388	4,632	4,876	5,200	5,433	0.9	1.2
Illinois River	83	90	110	134	158	188	209	3.8	3.4
Missouri River	330	331	332	333	335	337	338	0.1	0.1
Ohio River	3,509	3,533	3,600	3,680	3,759	3,859	3,928	0.4	0.5
Tennessee River	1,632	1,641	1,666	1,695	1,725	1,762	1,785	0.3	0.4
Arkansas River	699	701	707	714	720	728	734	0.2	0.2
Gulf Coast West	12,230	12,474	13,412	14,603	15,793	17,384	18,530	1.4	1.8
Gulf Coast East	6,036	5,914	5,748	5,611	5,495	5,421	5,399	-0.6	-0.3
Warrior River System	1,597	1,555	1,491	1,433	1,378	1,329	1,303	-0.8	-0.7
Great Lakes	261	271	321	358	394	443	482	2.5	2.3

a = less than 500 tons

Table XV-4

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY Other Commodities
ALTERNATIVE Trendlong2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77 90	90 03
Upper Mississippi	14	15	15	15	15	15	16	0.2	0.3
Lower Upper Mississippi	112	113	118	124	130	137	142	0.8	1.0
Lower Mississippi	1,693	1,707	1,746	1,792	1,838	1,896	1,937	0.4	0.6
Baton Rouge to Gulf	393	396	407	421	435	454	468	0.5	0.8
Illinois River	12	13	15	19	22	26	29 a	3.8	3.4
Missouri River	40	40	41	41	41	42	42	0.1	0.2
Ohio River	231	238	258	282	306	335	356	1.6	1.8
Tennessee River	92	93	97	102	107	112	116	0.8	1.0
Arkansas River	48	48	49	49	50	51	51	0.2	0.2
Gulf Coast West	1,001	999	1,021	1,055	1,090	1,145	1,186	0.4	0.9
Gulf Coast East	269	264	258	253	249	247	247	-0.5	0.2
Warrior River System	34	33	32	31	30	29	29	0.7	-0.5
Great Lakes	71	73	87	98	108	122	133	2.5	2.4
Total	4,010	4,033	4,144	4,282	4,421	4,611	4,752	0.5	0.8

a = less than 500,000 ton-miles

Table XV-5

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY: Other Commodities
ALTERNATIVE: Trendlong2003A

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	490	572	815	1,065	1,346	1,738	2,040	6.2	5.1
	Imports	522	550	618	689	739	773	785	2.2	1.0
Illinois River	Exports	23	26	38	49	62	80	94	6.2	5.1
	Imports	57	60	67	74	80	84	86	2.0	1.2
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	788	919	1,310	1,711	2,161	2,792	3,277	6.2	5.1
	Imports	727	765	861	959	1,029	1,076	1,093	2.2	1.0
Gulf Coast East	Exports	24	28	40	53	66	86	101	6.2	5.1
	Imports	91	95	107	120	128	134	136	2.2	1.0
Warrior River System	Exports	45	52	75	97	123	159	186	6.2	5.1
	Imports	47	49	56	62	66	70	71	2.2	1.0
South Atlantic Coast	Exports	1,041	1,214	1,730	2,261	2,856	3,689	4,329	6.2	5.1
	Imports	1,167	1,228	1,379	1,533	1,638	1,704	1,722	2.1	0.9
Middle Atlantic Coast	Exports	3,270	3,816	5,438	7,105	8,973	11,592	13,604	6.2	5.1
	Imports	4,367	4,593	5,158	5,735	6,129	6,375	6,441	2.1	0.9

Table XV-5 (continued)

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77 90	90 03
North Atlantic Coast	Exports	45	53	76	99	125	161	189	6.2	5.1
	Imports	485	510	573	637	680	708	715	2.1	0.9
Great Lakes and Seaway	Exports	123	144	205	268	339	438	514	6.2	5.1
	Imports	257	269	300	333	358	379	389	2.0	1.2
Washington/Oregon Coast	Exports	100	116	166	217	273	353	415	6.2	5.1
	Imports	1,496	1,740	2,330	3,126	4,095	5,340	6,270	5.8	5.5
Columbia-Snake Willamette River	Exports	25	30	42	55	70	90	106	6.2	5.1
	Imports	408	475	636	853	1,118	1,457	1,711	5.8	5.5
California Coast	Exports	607	708	1,009	1,318	1,665	2,151	2,524	6.2	5.1
	Imports	3,717	4,324	5,789	7,766	10,174	13,266	15,578	5.8	5.5
Alaska	Exports	20	24	34	44	56	72	84	6.2	5.1
	Imports	137	152	189	235	286	348	392	4.2	4.0
Hawaii and Pacific Territories	Exports	11	13	18	24	30	39	45	6.2	5.1
	Imports	69	76	95	118	144	175	197	4.2	4.0
Domestic Caribbean	Exports	67	79	112	146	185	239	280	6.2	5.1
	Imports	291	323	400	498	607	738	832	4.2	4.0
Total	Exports	6,679	7,794	11,108	14,513	18,329	23,678	27,787	6.2	5.1
	Imports	13,839	15,210	18,558	22,737	27,271	32,627	36,420	3.9	3.7

a = less than 500 tons

XVI - WATERBORNE TRAFFIC SUMMARY

HISTORICAL TRAFFIC PATTERNS

Overall, domestic waterborne traffic in all commodities has grown by an average of 0.5% per year from 1969 to 1977, according to Table XVI-1. Primary tonnage growth during this period was concentrated on the mainstem of the Mississippi River, with Upper Mississippi and Illinois shipments of grain-related export products the major factor behind the 7.2% average annual growth in Baton Rouge to Gulf receipts. Other growth areas included the Columbia-Snake/Willamette River, with total traffic up over 5% per year from 1969 to 1977, Gulf Coast East petroleum and chemical-related shipment growth of 5.1% per year, South Atlantic domestic movements up over 5% per year in total, and Domestic Caribbean traffic shipments up 17% per year. The Missouri River, Tennessee River, Middle Atlantic Coast, Washington/Oregon Coast and the Great Lakes/St. Lawrence Seaway had slight declines in traffic over the 1969 to 1977 period. The Great Lakes traffic fell sharply in 1977 due to a strike in iron ore mining industry.

Waterborne foreign trade activity in the 1969 to 1977 period was heavily weighted towards import growth, according to Table XVI-2. With increases in petroleum imports the major contributing factor, total United States waterborne imports grew at a compound annual rate of 7.7% over the period. The Gulf Coast was the major recipient of the oil imports, with Gulf Coast West foreign traffic up an average of 28.2% per year from 1969 to 1977. The Baton Rouge to Gulf Waterway segment grew at a similar rate to the Gulf Coast West, but due to grain-related exports as well as oil imports. Total foreign trade traffic from Baton Rouge to the Gulf increased from just over 41 million tons in 1969 to 157 million tons in 1977. Petroleum imports also contributed to the foreign trade traffic growth along the Washington/Oregon Coast from 1969 to 1977. Export growth was fairly stagnant along the East Coast of the United States, with the exception of moderate growth in the South Atlantic area. Washington/Oregon coast exports rose steadily in the 1969 to 1977 period, due to the foreign trade in wood and related products with Far Eastern Countries, especially Japan. Although

California exports fell in the period, imports almost doubled, reflecting the growth of United States foreign subsidiary production in Asia and the shipment of finished products back to the United States.

TOTAL TRAFFIC BY SEGMENT

Tables XVI-3 to XVI-6 summarize the NWS waterborne demand projection for the Trendlong scenario by reporting waterway segment through the year 2003 for all commodity groups - domestic versus foreign trade. Alternative macroeconomic scenario tables are found in Appendix B.

(a) Upper Mississippi

Total domestic traffic on the Upper Mississippi River is expected to more than double in the 1977 to 2003 period, from 31 million to almost 69 million tons. Major contributors to the traffic growth include: farm products, coal, food and kindred products and chemicals. Farm products - basically grain destined for export - are projected to increase to 30 million tons per year in 2003 from 11 million tons in 1977, with a compound annual rate of 4.3% per year from 1977 to 1990 and 3.1% per year through 2003. Total coal shipments rise from 2 million tons in 1977 to 13 million tons in 2003, primarily due to Western coal movement. Coal receipts rise to 18 million tons from 7 million tons in 1977 as a result of increased reliance on coal by Upper Mississippi utilities.

Food and kindred products - mainly exports of vegetable oils - increase from 1 million tons in 1977 to 3 million by 2003. Chemical receipts in the region grow from 2 to 5 million tons in the forecast period. In total, Upper Mississippi River shipments increase 4.6% from 1977 to 1990, slowing to 2.8% through 2003. Traffic receipts grow 3.1% in the 1977 to 1990 period, and 1.6% to the year 2003.

Table XVI-1

HISTORICAL
DOMESTIC TRAFFIC
(1000'S TONS)

COMMODITY : ALL COMMODITIES

SEGMENT	IN/OUT	69	70	71	72	YEARS 73	74	75	76	77	%GROWTH 69-77
Upper Mississippi	Shipped	11,860	14,330	14,736	17,175	18,617	20,609	19,769	22,067	20,619	7.2
	Received	13,976	15,293	15,814	16,735	13,799	14,526	15,751	15,009	16,474	2.1
Lower Upper Mississippi	Shipped	18,714	18,519	18,489	22,191	18,933	22,672	24,168	24,236	23,150	2.7
	Received	10,067	10,631	11,342	10,264	8,007	9,447	8,545	9,422	9,042	-1.3
Lower Mississippi	Shipped	12,039	11,955	11,725	10,662	9,487	11,209	10,169	11,881	11,143	-1.0
	Received	16,334	18,544	19,927	20,750	21,520	23,208	21,783	22,570	24,888	5.4
Baton Rouge to Gulf	Shipped	80,188	84,944	85,788	79,804	73,802	75,324	73,884	74,043	84,315	0.6
	Received	53,149	58,006	60,475	74,621	78,073	83,151	87,126	99,483	99,444	8.1
Illinois River	Shipped	26,793	28,738	28,745	33,280	35,230	33,857	36,380	35,382	32,515	2.4
	Received	35,805	37,757	36,834	38,102	39,187	40,420	38,160	34,584	31,248	-1.6
Missouri River	Shipped	6,076	6,516	6,374	6,125	5,894	6,697	5,288	5,533	5,612	-1.0
	Received	5,996	6,127	5,840	5,651	5,396	6,119	4,758	4,597	4,635	-3.2
Ohio River	Shipped	128,975	131,538	128,595	135,138	129,973	127,998	132,570	136,928	140,253	1.1
	Received	125,514	127,849	126,923	134,686	130,221	130,420	131,073	135,453	134,112	0.8
Tennessee River	Shipped	10,736	11,367	13,539	14,492	13,147	13,335	11;967	12,434	10,493	-0.3
	Received	18,383	18,235	18,297	18,458	18,352	15,710	16,756	16,752	17,459	-0.6
Arkansas River	Shipped	842	3,333	3,598	4,595	3,888	4,679	3,944	5,144	6,636	33.9
	Received	349	3,698	3,734	4,376	4,396	5,389	4,460	5,034	6,816	45.0
Gulf Coast West	Shipped	150,028	160,086	159,671	158,557	147,370	147,029	139,042	142,595	148,136	-0.2
	Received	80,711	77,728	77,222	79,139	77,897	78,806	68,742	66,429	75,159	-0.9
Gulf Coast East	Shipped	19,938	21,741	24,724	28,100	27,581	28,587	29,994	29,856	32,236	6.2
	Received	27,203	29,110	30,120	33,554	34,992	35,478	35,431	36,844	38,641	4.5
Warrior River System	Shipped	15,628	15,225	16,385	19,427	21,353	22,203	20,809	23,758	23,871	5.4
	Received	14,028	13,794	15,485	19,691	18,127	19,478	16,894	19,295	20,413	4.8
South Atlantic Coast	Shipped	8,282	9,187	9,369	11,332	13,231	12,437	11,221	13,842	12,484	5.2
	Received	24,192	25,114	25,153	27,616	31,150	30,602	30,730	35,593	37,490	5.6
Middle Atlantic Coast	Shipped	158,415	152,572	161,860	171,365	184,996	175,789	162,838	163,256	159,990	0.1
	Received	187,655	206,992	213,595	213,304	213,218	201,784	188,928	186,030	181,200	-0.4

Table XVI-1 (continued)

SEGMENT	IN/OUT	69	70	71	72	YEARS 73	74	75	76	77	%GROWTH 69-77
North Atlantic Coast	Shipped	10,855	11,003	10,937	11,507	11,571	11,836	11,150	10,796	9,914	-1.1
	Received	49,857	48,687	50,559	52,220	48,852	48,168	50,589	51,381	50,273	0.1
Great Lakes and Seaway	Shipped	159,208	157,787	139,295	144,053	155,365	146,145	128,809	132,865	109,590	-4.6
	Received	155,647	154,192	136,349	140,881	151,549	141,890	125,728	129,567	107,660	-4.5
Washington/Oregon Coast	Shipped	32,918	28,609	25,559	26,175	25,308	21,390	21,759	21,062	22,600	-4.6
	Received	32,782	27,602	25,617	23,654	23,678	19,846	19,487	21,173	24,992	-3.3
Columbia-Snake Willamette River	Shipped	12,314	13,580	13,938	15,075	14,702	21,983	22,048	24,617	22,406	7.8
	Received	16,593	17,905	17,702	19,480	18,820	24,888	24,819	26,895	25,848	5.7
California Coast	Shipped	46,880	46,029	42,065	37,833	40,664	37,687	38,441	43,942	43,257	-1.0
	Received	49,772	48,604	45,791	42,586	45,675	43,150	43,695	48,089	50,472	0.2
Alaska	Shipped	13,846	15,316	14,150	14,683	14,579	13,898	12,887	12,874	19,485	4.4
	Received	5,822	6,440	5,657	6,814	6,434	6,667	7,008	7,429	8,077	0.5
Hawaii and Pacific Territories	Shipped	4,658	4,790	4,760	5,555	5,570	4,605	5,806	5,737	5,412	1.9
	Received	7,270	8,463	7,083	7,977	7,095	6,679	6,863	6,520	8,230	-1.9
Domestic Caribbean	Shipped	6,298	18,748	23,117	29,585	34,296	34,912	31,772	33,547	32,405	22.7
	Received	4,387	5,143	5,900	6,160	8,720	9,058	7,386	8,247	7,931	7.7
Total	Shipped	935,290	965,914	957,420	996,718	1,005,158	994,881	954,715	986,396	976,501	0.5
	Shipped	935,290	965,914	957,420	996,718	1,005,158	994,881	954,715	986,396	976,501	0.5

Table XVI-2

HISTORICAL
FOREIGN TRADE
(1000'S TONS)

COMMODITY: ALL COMMODITIES

SEGMENT	IN/OUT	69	70	71	72	YEARS 73	74	75	76	77	%GROWTH 69-77
Upper Mississippi	Exports	0	0	0	0	0	0	0	0	0	NC
	Imports	0	0	0	0	0	0	0	0	0	NC
Lower Upper Mississippi	Exports	0	0	5	0	0	0	0	0	0	NC
	Imports	0	0	3	0	0	0	0	0	0	NC
Lower Mississippi	Exports	19	7	43	104	22	0	0	0	0	-100.0
	Imports	8	2	8	40	0	0	0	0	0	-100.0
Baton Rouge to Gulf	Exports	26,311	33,369	29,870	39,733	46,681	46,982	47,376	59,359	59,920	10.8
	Imports	15,631	16,388	18,575	19,023	26,837	37,233	45,838	66,749	97,255	25.7
Illinois River	Exports	3,825	3,823	3,862	3,206	4,232	2,629	2,723	2,874	2,571	4.8
	Imports	3,073	3,232	4,041	4,108	2,609	2,611	1,898	3,990	3,573	1.9
Missouri River	Exports	0	0	0	0	0	0	0	0	0	NC
	Imports	0	0	0	0	0	0	0	0	0	NC
Ohio River	Exports	0	0	0	0	0	0	0	0	0	NC
	Imports	0	0	0	1	0	0	0	0	0	NC
Tennessee River	Exports	0	0	0	0	0	0	0	0	0	NC
	Imports	0	0	0	0	0	0	0	0	0	NC
Arkansas River	Exports	0	0	0	0	0	0	0	0	0	NC
	Imports	0	0	0	0	0	0	0	0	0	NC
Gulf Coast West	Exports	20,270	28,944	27,037	28,869	43,527	35,575	35,911	34,000	35,406	7.2
	Imports	14,647	14,739	18,337	19,253	41,047	58,283	66,830	101,541	137,104	32.3
Gulf Coast East	Exports	14,345	14,823	15,058	17,824	18,642	17,252	17,720	18,082	21,499	5.2
	Imports	5,062	5,957	6,347	9,138	10,290	10,924	12,790	17,397	17,822	16.9
Warrior River System	Exports	2,504	2,940	2,325	3,054	3,856	3,963	5,405	5,745	5,521	10.4
	Imports	8,206	8,957	8,527	6,614	7,910	9,416	7,896	8,216	8,187	-0.1
South Atlantic Coast	Exports	4,910	5,519	5,426	5,735	6,648	7,364	7,179	7,776	8,618	7.3
	Imports	16,341	18,568	19,940	25,678	28,553	26,251	18,546	20,978	20,701	3.0
Middle Atlantic Coast	Exports	55,909	71,070	52,304	54,761	60,639	72,412	70,757	68,121	56,757	0.2
	Imports	136,736	136,281	136,330	154,222	188,175	178,223	156,194	160,126	168,692	2.7

Table XVI-2 (continued)

SEGMENT	IN/OUT	69	70	71	72	YEARS 73	74	75	76	77	%GROWTH 69-77
North Atlantic Coast	Exports	1,296	1,609	1,147	1,418	1,746	1,573	1,186	1,576	1,307	0.1
	Imports	43,874	50,033	48,624	49,472	53,091	45,996	39,918	38,153	33,997	-3.1
Great Lakes and Seaway	Exports	28,250	32,109	29,820	31,781	34,267	25,490	32,704	32,138	33,765	2.3
	Imports	21,537	20,964	21,928	21,101	25,651	20,732	19,558	26,655	29,255	3.9
Washington/Oregon Coast	Exports	12,306	14,491	12,269	16,371	18,882	17,421	16,144	19,478	18,060	4.9
	Imports	5,940	6,648	7,238	7,624	10,328	12,064	9,866	17,700	20,019	16.4
Columbia-Snake Willamette River	Exports	9,185	10,372	7,849	10,730	14,078	13,611	13,068	14,606	12,821	4.3
	Imports	2,775	2,879	2,602	3,239	3,241	4,245	3,892	3,769	4,045	4.8
California Coast	Exports	18,623	19,799	14,770	13,767	18,246	17,843	17,382	16,856	15,982	1.9
	Imports	38,001	17,579	24,650	31,083	42,304	40,671	40,962	48,431	60,187	5.9
Alaska	Exports	1,137	2,951	2,853	3,681	3,377	3,111	3,239	3,285	5,024	20.4
	Imports	853	1,089	1,102	1,056	1,174	1,735	1,530	1,166	1,619	8.3
Hawaii and Pacific Territories	Exports	120	141	113	218	283	111	143	119	147	2.5
	Imports	4,037	2,946	3,771	4,028	4,339	4,555	4,925	5,547	5,926	4.9
Domestic Caribbean	Exports	2,018	1,329	1,264	1,346	2,194	1,479	1,227	1,639	1,463	-3.9
	Imports	22,872	31,013	37,631	41,922	44,617	44,451	46,106	50,012	51,645	10.7
Total	Exports	201,029	241,296	205,816	232,596	277,321	266,816	272,184	285,653	278,861	4.2
	Exports	339,590	337,273	359,655	397,661	490,166	497,389	476,748	570,427	659,808	8.7

Table XVI-3

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY All Commodities
ALTERNATIVE Trendlong2003A

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Shipped	20,6.9	28,123	33,310	37,087	44,473	50,221	52,774	4 6	2 8
	Received	16,474	18,83[illegible]	21,133	21,577	27,539	29,887	30,397	3 1	1 6
Lower Upper Mississippi	Shipped	23,149	24,926	28,767	35,058	41,106	46,861	49,542	3 2	2 7
	Received	9,042	9,231	11,267	17,159	22,170	27,117	28,895	5 1	4 1
Lower Mississippi	Shipped	11,136	12,742	14,138	15,715	17,585	19,511	20,501	2 7	2 1
	Received	24,819	24,530	25,952	27,801	29,971	32,032	33,178	0 9	1 4
Baton Rouge to Gulf	Shipped	84,271	85,886	90,249	99,793	104,686	112,282	116,406	1 3	1 2
	Received	99,444	121,598	134,947	155,954	183,193	212,646	223,503	3 5	2 8
Illinois River	Shipped	32,515	35,021	39,481	40,589	46,944	51,911	53,870	1 7	2 2
	Received	31,245	34,932	38,809	42,377	46,513	50,803	53,050	2 4	1 7
Missouri River	Shipped	5,612	6,073	6,139	5,960	6,001	6,245	6,315	0 5	0 4
	Received	4,635	4,621	4,528	4,226	4,118	4,120	3,954	0 7	0 5
Ohio River	Shipped	140,247	145,575	175,394	204,527	239,391	270,155	284,726	2 9	2 6
	Received	134,112	138,262	163,037	176,063	193,533	210,476	219,579	2 1	1 7
Tennessee River	Shipped	10,493	10,649	11,087	12,285	16,551	19,716	21,511	1 2	4 4
	Received	17,457	17,552	17,895	19,706	22,750	26,153	28,279	0 9	2 8
Arkansas River	Shipped	6,636	6,868	7,194	9,454	11,484	13,224	13,710	2 8	2 9
	Received	6,816	6,847	6,849	6,643	6,622	6,772	6,639	-0 2	0 0
Gulf Coast West	Shipped	148,122	148,882	146,322	159,073	168,084	179,449	187,619	0 6	1 3
	Received	75,159	87,505	87,946	98,867	106,209	117,641	125,600	2 1	1 9
Gulf Coast East	Shipped	32,236	32,481	36,719	41,923	49,108	56,966	56,587	2 0	2 3
	Received	38,641	37,983	45,280	54,164	63,018	70,223	73,748	2 6	2 4
Warrior River System	Shipped	23,871	24,526	27,922	33,690	36,892	41,830	45,088	2.7	2 3
	Received	20,413	21,210	23,606	28,107	33,284	38,993	42,978	2 5	3 3
South Atlantic Coast	Shipped	12,464	11,950	11,752	12,123	11,774	12,181	12,774	-0 2	0 4
	Received	37,490	37,040	36,941	38,418	39,023	40,588	41,850	0 2	0 7
Middle Atlantic Coast	Shipped	159,990	163,283	169,878	179,113	184,938	189,572	192,706	0 9	0 6
	Received	181,200	183,292	179,551	189,517	195,913	201,201	204,871	0 3	0 6

Table XVI-3 (continued)

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Shipped	9,914	10,424	10,588	10,619	10,321	9,953	9,714	0.5	0.7
	Received	50,273	51,511	49,683	52,567	53,175	53,409	53,340	0.3	0.1
Great Lakes and Seaway	Shipped	109,590	147,920	163,165	179,688	201,044	223,932	238,502	3.9	2.2
	Received	107,660	143,939	158,770	174,569	195,413	217,452	231,231	3.8	2.2
Washington/Oregon Coast	Shipped	22,600	24,455	24,818	26,017	26,463	27,278	27,662	1.1	0.5
	Received	24,992	39,120	60,372	65,712	70,140	70,141	69,678	7.7	0.5
Columbia Snake Willamette River	Shipped	22,406	27,002	26,666	27,175	27,066	27,601	28,535	1.5	0.4
	Received	25,848	31,502	31,522	32,333	32,296	32,856	33,799	1.7	0.3
California Coast	Shipped	43,257	37,976	42,106	46,715	47,072	47,203	47,596	0.6	0.1
	Received	50,472	81,003	86,983	90,374	90,015	88,693	87,227	4.6	-0.3
Alaska	Shipped	19,485	89,101	101,374	102,033	102,301	102,635	102,861	13.6	0.1
	Received	6,077	7,117	7,673	8,465	9,052	9,729	10,157	2.6	1.4
Hawaii and Pacific Territories	Shipped	5,412	5,614	6,446	7,308	8,038	8,944	9,602	2.3	2.1
	Received	6,230	7,320	8,325	9,337	10,253	11,387	12,220	3.2	2.1
Domestic Caribbean	Shipped	32,405	33,726	36,544	40,364	43,162	45,594	47,135	1.7	1.2
	Received	7,931	8,200	8,791	9,373	10,083	10,944	11,568	1.3	1.6
Total	Shipped	976,428	1,113,204	1,209,858	1,326,309	1,444,485	1,563,262	1,625,715	2.4	1.6
	Received	976,428	1,113,204	1,209,858	1,326,309	1,444,485	1,563,262	1,625,735	2.4	1.6

* - less than 500 tons

Table XVI-4

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL, AND THROUGH

COMMODITY: All Commodities
ALTERNATIVE: Trendlong2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	30,874	39,503	45,167	50,164	58,730	65,917	68,666	3.8	2.4
Lower Upper Mississippi	77,493	90,031	103,464	117,101	139,660	161,037	170,410	3.2	2.9
Lower Mississippi	123,602	138,324	159,783	188,770	230,298	267,159	284,466	3.3	3.2
Baton Rouge to Gulf	187,257	210,746	231,620	268,263	311,325	356,360	375,250	2.8	2.6
Illinois River	54,342	60,926	68,200	71,913	81,755	90,748	95,070	2.2	2.2
Missouri River	6,735	7,255	7,434	7,369	7,499	7,846	7,963	0.7	0.6
Ohio River	172,739	179,053	212,891	246,420	288,280	325,561	343,890	2.8	2.6
Tennessee River	22,058	22,346	23,369	26,126	32,578	38,153	41,540	1.3	3.6
Arkansas River	9,396	9,686	10,314	12,857	15,069	17,069	17,642	2.4	2.5
Gulf Coast West	168,762	180,869	173,891	190,945	202,430	219,466	231,408	1.0	1.5
Gulf Coast East	69,061	68,795	79,485	91,722	107,155	121,947	125,511	2.2	2.4
Warrior River System	30,006	30,719	34,472	40,714	47,477	54,597	59,374	2.4	2.9
Great Lakes	115,807	154,950	170,425	186,992	208,922	232,274	247,067	3.8	2.2

a = less than 500 tons

Table XVI-5

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY All Commodities
ALTERNATIVE Trendlong2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	10,153	13,127	14,797	16,064	18,862	21,390	22,369	3.6	2.6
Lower Upper Mississippi	13,960	16,533	18,932	20,832	24,752	28,472	30,134	3.1	2.9
Lower Mississippi	71,393	81,191	94,800	112,616	139,143	162,574	173,557	3.8	3.4
Baton Rouge to Gulf	20,845	23,771	25,754	29,406	34,372	39,539	41,598	2.7	2.7
Illinois River	8,005	9,085	10,162	10,691	12,207	13,603	14,288	2.3	2.3
Missouri River	1,990	2,276	2,444	2,571	2,711	2,922	3,062	2.0	1.4
Ohio River	41,386	43,509	53,211	65,258	78,588	90,773	96,679	3.6	3.1
Tennessee River	3,602	3,735	4,001	4,498	5,565	6,503	7,090	1.7	3.6
Arkansas River	1,398	1,467	1,659	2,312	2,841	3,306	3,472	3.9	3.2
Gulf Coast West	18,800	19,421	20,290	22,838	24,661	26,916	28,397	1.5	1.7
Gulf Coast East	4,697	4,644	5,262	6,071	7,377	8,333	8,857	2.0	2.9
Warrior River System	4,686	4,885	5,571	6,854	7,627	8,831	9,673	3.0	2.7
Great Lakes	56,759	80,907	88,864	97,524	109,619	122,774	131,389	4.3	2.3
Total	257,673	304,551	345,746	397,534	468,324	535,937	570,565	3.4	2.8

* = less than 500,000 ton-miles

Table XVI-6

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY: All Commodities
ALTERNATIVE: Trendlong2003A

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	59,920	74,760	88,463	92,393	109,848	125,283	133,422	3.4	2.9
	Imports	97,255	108,810	124,390	128,729	140,494	153,207	161,356	2.2	1.8
Illinois River	Exports	2,571	4,435	5,060	5,096	6,153	7,046	7,424	5.4	2.9
	Imports	3,573	2,672	3,266	3,601	3,924	4,283	4,516	0.1	1.8
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	35,406	47,104	49,917	52,428	56,827	62,129	67,978	3.1	2.0
	Imports	137,104	153,612	174,504	179,549	195,214	211,868	222,458	2.1	1.7
Gulf Coast East	Exports	22,089	24,976	29,409	24,606	21,461	18,377	16,506	0.8	-3.0
	Imports	17,812	20,063	22,426	23,260	24,679	26,343	27,440	2.1	1.3
Warrior River System	Exports	5,521	7,801	10,230	11,758	13,834	15,825	16,951	6.0	2.9
	Imports	8,167	8,962	9,793	12,685	15,200	17,736	19,626	3.4	3.4
South Atlantic Coast	Exports	8,618	10,259	12,443	13,076	14,115	15,353	16,220	3.3	1.7
	Imports	20,701	19,052	19,927	20,958	20,794	21,047	21,372	0.1	0.2
Middle Atlantic Coast	Exports	56,757	64,433	75,154	79,692	89,833	100,110	106,236	2.6	2.2
	Imports	168,692	161,531	170,864	181,341	186,990	194,548	199,483	0.6	0.7

Table XVI-6 (continued)

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Exports	1,307	1,657	2,059	2,136	2,221	2,322	2,392	3.9	0.9
	Imports	33,997	27,411	34,605	40,468	41,632	43,304	45,322	1.3	0.9
Great Lakes and Seaway	Exports	33,765	46,109	54,424	58,636	65,355	72,300	77,119	4.3	2.1
	Imports	29,255	29,067	32,793	35,830	39,247	43,376	46,187	1.6	2.0
Washington/Oregon Coast	Exports	18,060	20,724	22,270	20,115	21,414	23,042	23,882	0.8	1.3
	Imports	20,019	12,569	34,142	39,809	45,842	48,292	49,709	5.4	1.7
Columbia Snake Willamette River	Exports	12,821	15,845	16,826	16,091	16,035	16,609	18,621	1.8	1.1
	Imports	4,045	3,743	4,410	4,975	5,856	6,832	7,507	1.6	3.2
California Coast	Exports	15,982	19,782	21,574	22,427	24,345	26,599	28,183	2.6	1.8
	Imports	60,187	26,431	29,739	32,851	36,147	40,481	43,517	-4.6	2.2
Alaska	Exports	5,024	3,324	3,163	3,004	2,948	2,928	2,944	-3.9	-0.2
	Imports	1,619	1,391	1,427	1,488	1,557	1,648	1,707	-0.6	1.1
Hawaii and Pacific Territories	Exports	147	153	177	191	205	227	242	2.0	1.9
	Imports	5,926	4,620	4,663	4,868	4,814	4,818	4,851	-1.5	0.0
Domestic Caribbean	Exports	1,463	2,077	1,826	1,844	1,954	2,089	2,187	1.8	1.3
	Imports	51,645	51,931	55,533	60,908	62,680	64,193	65,119	1.3	0.5
Total	Exports	279,451	343,440	392,996	403,495	446,547	490,239	520,704	2.9	2.0
	Imports	659,998	631,866	722,481	771,319	825,070	881,974	920,169	1.2	1.4

a = less than 500 tons

(b) Lower Upper Mississippi

Total waterborne shipments in the Lower Upper Mississippi River increase from 23 million to almost 50 million tons from 1977 to 2003, a compound annual rate of just under 3.0%. Receipts of waterborne commodities grow by over 4.3% per year, increasing to 29 million tons by 2003. Farm products, coal, food products and chemicals are again the major factors behind the growth. Farm product shipments double to 6 million tons over the forecast period. Coal shipments rise from 7 to 25 million tons, reflecting the growth of intermodal coal terminals. Receipts of waterborne coal are also up substantially, growing from 2 to 20 million tons, as utilities burning coal come on-line in the region. Non-metallic minerals traffic falls off at a 2.0% rate per year, due to reductions in sand and gravel traffic. Chemical traffic on this section of the river doubles to 3 million tons, while petroleum product movements are flat through 2003.

(c) Lower Mississippi

The Lower Mississippi River waterborne domestic traffic shipped increases from 11 million tons in 1977 to 21 million by 2003 while traffic receipts of all commodities grows from 25 million tons to 33 million. As before, farm and food products, coal and chemicals are the major areas of traffic growth. Farm product shipped - primarily soybeans - is forecast to grow from 4 million to 10 million tons in the forecast period. Coal receipts are expected to jump from 4 million to 9 million tons as southern electric utilities convert from oil and gas to coal. Chemical traffic doubles to 3.8 million tons, while petroleum movements increase 2 million tons up from 10 million in 1977. Cement traffic doubles to 2 million tons in 2003 as downbound cement traffic grows in line with construction activity in the region. Other commodity traffic is basically flat over the forecast period. The Lower Mississippi River (above Baton Rouge, Louisiana) has no current import/export traffic movements.

(d) Baton Rouge to Gulf

The Baton Rouge to Gulf waterway segment serves as the primary interface between the inland river system, Gulf Coastal waterway and United States foreign trade activity. Total domestic shipments of all commodities from this segment will increase from 84 to 116 million tons over the 1977 to 2003 period, for an annual average increase of 1.3%. Traffic receipts grow rapidly, up from 99 million tons to over 223 million tons in 2003. Farm products, coal, fertilizers, food products, chemicals, and petroleum products all contribute to the growth in segment terminations. For example, farm product receipts jump from 38 to 96 million tons, up 3.2% per year from 1977 to 2003. Coal traffic for export increases to 39 million tons in 2003, up from 3 million in 1977. Crude petroleum and petroleum product receipts increase over 20 million tons during the forecast period. Foreign traffic growth is also substantial, with exports up over 3.0% per year to 2003 and imports increasing 2.0% per year. For exports, farm products, food products, coal and chemicals lead the list. Metallic ores, crude oil, food products, primary metals and chemicals are major import growth sectors in the forecast period.

(e) Illinois River

The Illinois River (including the Port of Chicago) domestic waterborne traffic growth will be about equally balanced in shipments and receipts over the forecast period. Total domestic traffic is expected to increase, on average, 2.2% per year from 1977 to 2003, reflecting growth in farm product exports, metallic ores traffic, coal and chemicals. Exports via Chicago of farm products are expected to jump by 5 million tons to 6 million tons in 2003. Imports, especially metallic ores, show some growth over the period.

(f) Missouri River

Missouri River domestic traffic, concentrated in farm and food products as well as non-metallic minerals, is expected to increase by 0.5% per year (shipments) to year

2003. Receipts are likely to fall by 0.6% per year in the forecast period due to a decline in non-metallic minerals traffic. Farm product movements to export show the largest increase - 1 million tons - of any commodity group in the forecast years.

(g) Ohio River

Domestic waterborne shipments on the Ohio River increase from 140 million tons to 285 million tons by 2003, 2.7% per year. Coal traffic is by far the major growth area, with total shipments up 3.5% per year from 98 million to 236 million tons. Coal receipts increase at 2.5% per year from 83 to 157 million tons. Chemical traffic on the Ohio grows at a 4.0% rate, increasing from 9 million to 26 million tons in 2003, chiefly due to the location of coal-fired petrochemical plants on the river. Both stone, clay and glass as well as primary metals product waterborne flows increase by 2 million tons - 2.0% per year - over the forecast period.

(h) Tennessee River

Coal traffic growth provides the major increases in domestic waterborne flows on the Tennessee River from 1977 to 2003. Total coal shipments are up 10 million tons to 14 million with average annual growth of 2.5% from 1977 to 1990 and 7.4% per year from 1990 to 2003. Coal receipts on the Tennessee River grow by 7 million tons, up over 3.0% per year to 2003. Other product groups experiencing mild increases in traffic to 2003 include: metallic ores, up 200,000 tons; food products, up 700,000 tons; chemicals, up 3 million tons, and petroleum products, increasing by 1 million tons. Non-metallic minerals fall 2 million tons over the forecast period, due to lower sand and gravel movements.

(i) Arkansas River

Total domestic traffic movements on the Arkansas River continue to grow in-line with overall waterways traffic in the forecast period at 2.4% per year. Total traffic increases from 9.4 million in 1977 to 17.6 million tons in 2003. Coal shipments, up over 7 million tons from 1977 to 2003 is the primary growth commodity. Other products experiencing some growth include farm products and metallic

ores. Non-metallic minerals traffic drops by 2.5 million tons to 3.5 million over the forecast period, due to competition from landside sand and gravel quarries.

(j) Gulf Coast West

Gulf Coast West domestic traffic (total) increases from 169 million tons to over 231 million tons by 2003, a compound annual rate of 1.3%. Coal, crude oil, non-metallic minerals (fertilizers), chemicals, and other (miscellaneous manufacturers) are the major domestic growth commodities through 2003, with coal receipts up 10 million tons, chemicals up over 20 million tons, crude oil traffic increasing 15 million tons, and petroleum products growing 9 million tons. Exports, consisting of farm products, are expected to grow by almost 30 million tons between 1977 and 2003. Import growth to the Gulf Coast West of 1.9% per year in the forecast period is primarily due to crude oil imports.

(k) Gulf Coast East

Domestic waterborne traffic along the Gulf Coast East is expected to grow at 2.3% per year from 1977 to 2003, with total tons increasing from 69 million to almost 126 million. Coal, fertilizers, and chemical flows are the primary growth commodities, with coal receipts up 32 million tons between 1977 to 2003, fertilizer shipments up 10 million tons, and chemicals increasing 1 million tons. Petroleum products traffic is basically flat over the forecast period. The major change on this segment is the decrease in fertilizer exports from 12 to 3 million tons over the forecast period, with imports increasing 2 million tons to 5 million by the year 2003.

(l) Warrior River System

Warrior River System domestic waterborne traffic almost doubles to about 59 million tons from 1977 to 2003, an average annual increase of 2.6%. Foreign trade growth, evenly split between imports and exports, averages slightly better than 3.5% per year to 2003. Metallic ores (up 4.3% per year) and coal (up 3.5% per year) account for

the majority of domestic and foreign growth. Coal exports increase by over 6 million tons in the forecast period while metallic ore imports grow by 11 million tons to 17 million by the year 2003. Farm products (mainly exports), crude oil and chemical traffic also show increases of nearly 2% per year in the forecast years.

(m) South Atlantic Coast

Waterborne traffic growth along the South Atlantic coast is generally concentrated in foreign trade, although coastwise metallic ores increase 1 million tons, and chemicals 2 million tons by the year 2003. Farm products, lumber and wood, pulp and paper and miscellaneous manufactures lead the list of export commodity growth. Ore and food product imports increases just about balance declines in petroleum product imports of 3 million tons during the forecast period. Overall, domestic waterborne shipments from the South Atlantic Coast are flat to 2003, while received traffic increases about 5 million tons. Total exports almost double over the period to 16 million tons, while imports remain flat, due to declining petroleum in flows.

(n) Middle Atlantic Coast

Substantial declines in coastwise and imported petroleum waterborne flows along the Middle Atlantic Coast result in slow growth in domestic and import traffic from 1977 to 2003. Domestic shipments grow by an average .6% per year to 2003, imports increase at the same rate, while exports grow an average of 2.4% per year. Export growth is strong in coal (up 17 million tons to 49 million), manufactured products (up 11 million to 14 million) and farm products (increasing from 13 million to 30 million tons - 3.2% per year). Crude oil imports are also up 20 million tons, about 1.0% per year to 2003. Metallic ores (up 6 million tons to 20 million), non-metallic minerals (up 3 million tons), food products (up 8 million to 14 million), and other manufactures (up 2 million tons) lead the imports. Coastwise trade in chemicals grows by 3.0% per year to over 12 million tons by 2003, while coal movements to water-served utilities along the East Coast jump from 5 million tons to 40 million over the forecast period.

(o) North Atlantic Coast

Total coastwise waterborne movements along the North Atlantic Coast are expected to show little growth in the forecast period. Total receipts of domestic tonnage are up about 3 million tons to 53 million by 2003, due primarily to chemical, coal and fresh fish traffic growth. Export trade increases about 1 million tons over the period, and is divided across a number of commodity groups. Imports, led by crude oil, food products, primary metals, and other commodities grow by 11 million tons to 45 million in 2003, up about 1.1% on average per year.

(p) Great Lakes and Seaway

Both domestic and foreign traffic growth potentials for the Great Lakes and St. Lawrence Seaway are some of the highest for any United States waterway segments in the study. Domestic traffic growth, led by metallic ores (increasing from a strike-depressed 45 million tons in 1977 to 120 million in 2003), coal (up 17 million tons to 37 million), non-metallic minerals (up 30 million tons to 66 million), and cement (up almost 3 million tons to 6.2 million), is expected to increase 3.8% from 1977 to 1990 and 2.2% through 2003. Foreign trade activity, paced by farm products exports (up 14 million tons to 24 million), metallic ore imports (up 12 million tons to 30 million), coal exports to Canada (up 20 million tons to 37 million), and primary metals imports (up 2.9 million) has a compound annual growth rate over 2.2% from 1977 to 2003.

(q) Washington/Oregon Coast

The major shift in waterborne domestic traffic along the Washington/Oregon coast is the coastwise Alaskan crude oil flows to the proposed Northern Tier Pipeline. These movements are expected to increase total receipts of petroleum by ten-fold to 46 million tons by 2003. Other major changes are a ten-fold increase in farm product exports to 10.2 million tons over the period, a decline of lumber and wood exports by 5 million tons to 8 million by 2003, and a growth in manufactured product imports of 5

million tons, or 5.4% per year. Overall, exports grow by about 6 million tons to 24 million by 2003, while imports jump to 4.6 million tons from 2.0 million in 1977, a compound annual increase of 3.4% per year to 2003. Domestic traffic, net of crude oil flows grows about .7% per year from 1977 to 2003.

(r) Columbia-Snake/ Willamette River

Rapid growth in farm product exports (up 7.5 million tons to 14 million by 2003) is partially offset up a 2 million ton drop in lumber and wood exports for the Columbia-Snake Waterway. Overall, total domestic movements are expected to increase by 1.6% per year to 1990 and 0.4% per year through 2003. Export growth will be about 5 million tons over the period, with imports almost doubling to 7.5 million tons (primarily chemicals and manufactured products). Domestic waterborne movements of wood and lumber products are expected to reach 12.7 million tons by 2003, up 1.8% per year to 1990, but only .3% per year through 2003. Internal farm product movements more than double during the forecast period.

(s) California Coast

The transloading of Alaskan crude oil for shipment to the Gulf Coast via the Panama Canal plus the use of Alaskan crude at West Coast refineries results in a jump in domestic crude oil flows to 56 million tons from 22 million and a fall of 30 million tons in crude imports to 12 million at California ports during the forecast period. In addition, farm product exports jump from 3.2 million tons to 11.5 million tons, and food product exports double as do waste and scrap exports (to 4 million tons). Imports of miscellaneous manufactures also experience a high growth rate of 5.4% per year, raising tonnage from 4 million to 16 million over the forecast period. Overall, California Coast domestic shipments increase only slightly (4 million tons) while receipts are up sharply due to Alaskan crude flows. Export traffic almost doubles to 28 million tons as imports fall off initially due to the oil shift to domestic sources.

(t) Alaska

In comparison to the increase in domestic crude oil shipments from 15 million tons to 96 million tons over the forecast period, other traffic changes are quite small. Domestic flow increases are led by food products (up 200,000 tons), lumber (up 1 million tons), chemicals (increases of 200,000 tons expected), and other manufactured products (up 2 million tons to 3 million). Due to deterioriating conditions in the world lumber markets, Alaskan foreign trade actually declines during the forecast period by 2 million tons. Imports are basically constant over the 1977 to 2003 period.

(u) Hawaii and Pacific Territories

Inter-territorial movements between the United States mainland and Hawaii/Pacific Territories are expected to almost double for both shipments and receipts over the forecast period. Led by other manufactured products, food and kindred products and cement traffic, domestic trades increase at about 2.6% per year to 1990 and 2.1% per year through 2003. Due to declines in petroleum consumption, the major component of Hawaii/Pacific Territories foreign trade, imports decline about 1 million tons to 4.9 million per year in 2003.

(v) Domestic Carribean

As in the case of Alaska, Domestic Caribbean waterborne traffic is dominated by crude oil and petroleum product movements to and from Virgin Island refineries. Total crude oil imports to the Caribbean are expected to grow by 13 million tons over the forecast period to 55 million. An additional 10 million tons of petroleum products will be shipped to the United States mainland over the 1977 to 2003 period. Other areas of waterborne traffic increase include: farm products (up 500,000 tons to 1.2 million), food product domestic and import flows (up 1.2 million tons), chemical shipments to the United States (up almost 4 million tons), and other manufactured product flows (up over 2 million tons to 3.3 million). Overall,

domestic traffic via water grows about 1.5% per year to 1990 and 1.4% per year through 2003. Foreign trade activity in the Domestic Carribbean increases about 1.5% per year to 1990, slowing to .7% per year to 2003.

XVII - CONCLUSIONS

Domestic waterborne traffic demand is projected to grow from 976 million tons in 1977 to 1,326 million tons in 1990 (2.4% per year) and to 1,626 million tons in 2003 (1.6% per year). This compares with relative flatness through the 1970s, with tonnages fluctuating between 935 million and 1,005 million tons between 1969 and 1977. Of the 650 million ton increase in domestic waterborne transportation demand over the forecast period, 262.6 million tons (40.4%) are represented by coal, which is expected to grow at 4.5% per year between 1977 and 1990, and 3.2% per year from 1990 to 2003. Over the period, coal increases its share of total domestic waterborne traffic demand from 16% in 1977 to 26% in 2003. This rapid waterborne demand growth is fueled by a growing share for coal-fired utilities throughout the forecast period as well as the development of coal-based synfuels capacity on the waterways. Other commodities which contribute to the strength of domestic waterway demands between 1977 and 2003 include farm products (from 49.4 to 105.5 million tons), chemicals (46.1 to 105.9 million tons), metallic ores (52.4 to 137.4 million tons), food and kindred products (15.6 to 30.0 million tons), and primary metals (9.1 to 13.9 million tons).

Domestic waterborne transportation demand in farm and food products is heavily dominated by barge movements to Lower Mississippi and Columbia River export ports. The rapid growth in barge transportation of the commodities is dependent on 3%-4% growth in grain exports and maintenance of 1979-1980 shares of barge-to-Gulf export distribution. Grain production shortfalls or congestion at upriver locks or Gulf ports could lead to disappointment of both the export and domestic projections.

The 130% increase in chemicals traffic between 1977 and 2003 reflects growth in both industrial and agricultural chemicals, with the more rapid industrial chemicals growth spurred by continued location of large scale chemical plants at water-served sites in the Gulf area, and development of coal-based plants on the Lower Mississippi and Ohio Rivers in the last half of the forecast period.

The 162% increase in domestic waterborne metallic ores demand is exaggerated by the strike-depressed Great Lakes movements in the base year of 1977. The 75% increase in domestic waterborne metallic ores demand between 1980 and 2003 reflects a reasonable recovery of the United States steel industry (raw steel production up 65.5% between 1977 and 2003) and development of substantial direct reduction capability in the last half of the forecast period in response to iron and steel scrap shortages.

Domestic waterborne traffic demand is slowed by flat or declining demand for the waterborne transportation of petroleum products (364.4 million tons in 1977 to 366.1 million tons in 2003), non-metallic minerals (115.0 to 140.3 million tons) waste and scrap (14.3 to 13.9 million tons), and lumber and wood products (23.2 million tons to 29.9 million tons).

The relatively rapid growth in the demand for domestic waterborne transportation results from growth in water-served regional industries and not from acquisition of market shares from other modes. Thus, the market share of barge coal actually declines slightly over the forecast period in spite of East Coast utility conversions from oil to coal boilers and riverfront synfuels development. Similarily, railroads maintain strong 1979 market shares in grain export markets, including a 10% market share for Pacific Coast rail-delivered feed grain exports. Land modes actually increase market share in several commodity groups. For example, rail and truck increase market shares of non-metallic minerals due to shifts toward land-based quarrying of sand and gravel and recovered as opposed to Frasch sulfur.

Waterborne foreign trade demand also grows steadily over the forecast period, with exports growing 2.9% from 1977 to 1990 and 2.0% thereafter, and imports growing at 1.2% and 1.5%, in the two periods respectively. Leaders in export growth are farm products, which increase from 104 million tons in 1977 to 255 million tons in 2003, coal (53.9 million tons to 107.4 million tons), and miscellaneous commodities, which grow by 5.7% per year reflecting strength in United States exports of manufactured commodities and fish. Import traffic growth is led by crude

petroleum, which increases by 155 million tons (405 to 560 million tons), metallic ores, which grow from 59.6 to 101.8, primary metals (22.4 million to 40 million tons), and miscellaneous manufactures (13.8 to 36.4 million tons). The risks to these foreign trade projections are in either direction, depending on the commodity. For example, the strong grain export growth depends on the ability of the farm sector to increase corn production by almost 50% over the 1977-2003 period, based mostly on increases in yield per acre. Similarily, there is a downside risk in petroleum imports if OPEC price policy is even more severe than projected and/or if United States fuel conservation and substitution measures are even more effective than forecast. On the other hand, increased coal substitution abroad could draw even harder on United States sources, and United States phosphate rock capabilities could prove more economic than represented in the NWS projections described herein. In order to address these and other potentialities, alternative projections have been developed for inclusion in the ten NWS scenarios.

GLOSSARY OF TERMS

AISI: American Iron and Steel Institute.

AIWW: Atlantic Intracoastal Waterway.

Badenergy2003A: A Macroeconomic forecast that estimates higher crude oil prices during the forecast period. From 1981 to 2003, the price of imported oil is assumed to rise at a rate of 1.5 percentage points faster per year, so that imported oil prices are 36.3% above the Trendlong scenario by 2003.

Baseline: Refers to the Trendlong2003A scenario.

CCDWC: Commodity Code for Domestic Waterborne Commerce - four digit number used by the Army Corps of Engineer Waterborne Commerce Statistics Center to identify specific commodities for reporting purposes. Previously known as CCCS codes.

Analysis Commodity: Forty-eight commodity groups defined as aggregates of the CCDWC codes for NWS reporting purposes.

Reporting Commodity: Fourteen commodity groups defined as aggregates of the 48 analysis commodities for NWS reporting purposes.

Compound Annual Growth: Calculates the growth rate over a period of time, including the effects of increases or decreases in the time series on a year-by-year basis that accounts for multiplicative impacts on overall period growth.

COE: Army Corps of Engineers.

Demand Projections: Forecast of future industry or transportation activity.

Econometric: The analysis of historical relationships between a time series and a set of explanatory variables, including the use of estimated relationships to forecast future values of the time series.

GIWW: Gulf Intracoastal Waterway.

Industrial Production Index: A measure of the value-added by an industry sector to the commodities it processes. The index measures growth in the industry, relative to other sectors.

Largergovt2003A: A Macroeconomic forecast that postulates a significantly larger government share in total economic activity. Total government spending rises from 32.3% of GNP in 1981 to 36.2% in 2003, compared to a constant share in the Trendlong scenario.

LOOP: A deep draft oil transfer facility in the Gulf of Mexico.

Macroeconomic Scenario: A collection of judgements about the future of the United States economy that are used to develop a forecast of future economic activity. Typical judgments include the role of the government in the economy and energy prices.

Market Share: The percentage of a defined economic market attributable to a firm. For example, waterways have a market share of total coal shipments in the United States.

NWS: National Waterway Study.

Price Deflation: Adjusting a current dollar measure to produce a constant dollar measure is accomplished using a series of how prices of the measure have changed over time (the price deflator).

Real Wages: Wage measures corrected for general inflation over time. Measures changes in total hours worked or how energy prices relate to general price changes.

Segment: A stretch of inland or coastal waterway including all contiguous ports and facilities. Can refer to bordering banks and shores as well as component waterway projects and channels.

Analysis Segments: Sixty-one segments defined for National Waterway Study to encompass all commercial ports and waterways for analysis purposes (Appendix A).

Reporting Segments: Twenty-one segments defined as aggregates of the analysis segments for reporting purposes (Appendix A).

Sensitivity: Testing how a measure changes when an underlying explanatory factor shifts. For example, analyzing the impact of changing gasoline prices on the quantity of gasoline demanded.

Ton: A short ton (= 2000 pounds) unless otherwise noted.

Ton-Mile: A statistical measure referring to the movement of one ton a distance of one mile. Thus, a movement of 10 tons for 10 miles equals 100 ton-miles.

Transit Time: Total time involved in moving equipment through a facility. For example, the time a towboat and barges take to transit a lock on the river system.

Trendlong2003A: A Macroeconomic forecast that estimates that the economy returns to its balanced growth path by the mid-1980s, in the context of moderating inflation.

Unconstrained Traffic De and: Traffic growth unrestricted by transportation facility capacities.

Variable: A concept that is allowed to change over time, as opposed to a parameter which is assumed to be constant over time.

WCSC: Waterborne Commerce Statistics Center - Data Collection and publication center for the Army Corps of Engineers.

TRAFFIC TERMINOLOGY:

Inbound: Traffic which terminates on a given segment, having originated on a different segment.

Outbound: Traffic which originates on a given segment, but terminates on a different segment.

Through: Traffic which traverses all or part of a given segment, but originates and terminates on other segments.

Within: Traffic which both originates and terminates on a given segment. Also occasionally referred to as internal or local traffic, although these terms have other formal meanings.

Lakewise: Domestic waterborne traffic which moves between ports on the Great Lakes.

Coastwise: Domestic waterborne traffic receiving carriage over the ocean or the Gulf of Mexico (e.g., New Orleans to Tampa, Chicago to Boston, or New York to San Francisco). Does not include traffic within Chesapeake Bay or Puget Sound.

Internal: Domestic waterborne traffic between ports or landings where the entire movement takes place on inland waterways or on both inland waterways and the Great Lakes. Also includes marine products taken from the ocean beds (sand and gravel, shells, fish), and traffic between offshore installations and inland waterways.

Local: Waterborne movements which occur wholly within the confines of a given port. Also, marine products taken from the Great Lakes.

Intraterritory: Traffic between ports in the Virgin Islands and Puerto Rico.

Received: Unloaded from a barge or vessel in a specified area. Also referred to as "terminated" or "terminating" in the area.

Shipped: Loaded onto a barge or vessel in a specified area. Also referred to as "originated" or "originating" in the area.

National Waterways Study

FINAL REPORT

TRAFFIC FORECASTING METHODOLOGY APPENDIX

NATIONAL WATERWAYS STUDY

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APPENDIX A

NATIONAL WATERWAYS STUDY

REPORTING AND ANALYSIS COMMODITIES

REPORTING AND ANALYSIS WATERWAY SEGMENTS

NWS Commodity Groups
Reporting and Analysis

Reporting Number	Analysis Number	Commodity	CCCS Code
I.		Farm Products	
	1	Corn	0103
	2	Wheat	0107
	3	Soybeans	0111
	4	Other Farm Products	0101, 0102, 0104, 0105, 0106, 0112, 0119, 0121, 0122, 0129, 0131, 0132, 0133, 0134, 0141, 0151, 0161, 0191
II.		Metallic Ores	
	5	Iron Ore and Concentrates	1011
	6	Other Ores (including Bauxite)	1021, 1051, 1061, 1091
III.		Coal	
	7	Coal and Lignite	1121
IV.		Crude Petroleum	
	8	Crude Petroleum	1311
V.		Nonmetallic Minerals	
	9	Sand, Gravel, and Crushed Rock	1442
	10	Limestone	1411
	11	Phosphate Rock and Other Fertilizers	1471, 1479
	12	Sulphur	1492, 1493

	13	Other Nonmetallic Minerals	1412, 1451, 1494, 1499, 1491
VI.		Food and Kindred Products	
	14	Vegetable Oils	2091
	15	Grain Mill Products	2041, 2042, 2049
	16	Other Food Products	2011, 2012, 2014, 2015, 2021, 2022, 2031, 2034, 2039, 2061, 2062, 2081, 2092, 2094, 2095, 2099
VII.		Lumber and Wood Products	
	17	Logs (including Pulpwood)	2411, 2415
	18	Rafted Logs	2412
	19	Lumber and Plywood	2421, 2431
	20	Other Lumber and Wood Products	2413, 2414, 2416, 2491
VIII.		Pulp, Paper and Allied Products	
	21	Pulp	2611
	22	Other Pulp and Paper Products	2621, 2631, 2691
IX.		Chemicals	
	23	Sodium Hydroxide	2810
	24	Crude Tar, Oil and Gas Products	2811
	25	Alcohols	2813
	26	Benzene and Toluene	2817
	27	Sulphuric Acid	2818

	28	Other Chemicals	2816, 2819, 2812, 2821, 2822, 2823, 2831, 2841, 2851, 2861, 2876, 2891, 2891
	29	Nitrogenous Chemical Fertilizers	2871
	30	Potassic Chemical Fertilizers	2872
	31	Phosphatic Chemical Fertilizers	2873
	32	Other Fertilizer Products	2879, 2875
X.		Petroleum and Coal Products	
	33	Gasoline	2911
	34	Jet Fuel and Kerosene	2912, 2913
	35	Distillate	2914
	36	Residual	2915
	37	Other Petroleum and Coal Products, nec	2916, 2917, 2918, 2921, 2951, 2991
XI.		Stone, Clay, Glass, and Concrete Products	
	38	Cement	3241
	39	Other Stone, Clay, Glass Products	3271, 3211, 3251, 3281, 3291
XII.		Primary Metals Products	
	40	Coke	3313
	41	Iron and Steel Primary Forms	3314
	42	Steel Mill Products (shapes, plates, pipe and tube)	3315, 3316, 3317, 3311, 3312, 3318

	43	Primary Metals	3311, 3312, 3318, 3319, 3321, 3322, 3323, 3324
XIII.		Waste and Scrap	
	44	Metal Scrap	4011, 4012
	45	Other Scrap	4022, 4024, 4029
XIV.		Other Commodities	
	46	Marine Shells	0931
	47	Miscellaneous	
		Forest Products	0841, 0861
		Fish	0911, 0912 0913
		Ordnance	1911
		Tobacco	2111
		Textiles	2211, 2212, 2311
		Furniture	2511
		Printed Matter	2711
		Rubber Products	3011
		Leather	3111
		Fabricated Metal	3411
		Machinery	3511, 3611
		Transportation Equipment	3711, 3721, 3731, 3791
		Instruments, Optical Goods, etc.	3811
		Miscellaneous Manufactures	3911
		Water	4111
		Commodity, nec	4112
		LCL Freight	4113, 9999
	48	Department of Defense Cargo Water Improvement Materials	4118

NATIONAL WATERWAYS STUDY
REPORTING SEGMENTS

Segment Number	Analysis Segment Combinations	Segment Name	Description
1	(1)	Upper Mississippi	Minneapolis to Illinois River
2	(2,3)	Lower Upper Mississippi	Illinois River to Cairo
3	(4,5,6)	Lower Mississippi	Cairo to Baton Rouge
4	(7,8) (25,26,27)	Baton Rouge to Gulf	Baton Rouge including port to Mouth of Passes
5	(9)	Illinois River	Lake Michigan to mouth of Illinois River
6	(10)	Missouri River	Head of naviga-tion to mouth
7	(11-21)	Ohio River	Head of naviga-tion to Mississippi River
8	(22,23)	Tennessee River	Head of naviga-tion to mouth
9	(24)	Arkansas River	Head of naviga-tion to mouth
10	(28-30), (34)	Gulf Coast West	New Orleans to Brownsville
11	(31-33), (38)	Gulf Coast East	New Orleans to Key West

12	(35-37)	Tombigbee-Alabama Coosa-Black Warrior River	Heads of navigation to mouth including Tennessee-Tombigbee Waterway
13	(39,40)	South Atlantic Coast	Key West to North Carolina-Virginia boundary
14	(41,42)	Middle Atlantic Coast	North Carolina/Virginia boundary to Long Island Sound
15	(44)	North Atlantic Coast	Long Island Sound (NED/NAD Boundary) to St. Croix River, Mair
16	(43,45-49)	Great Lakes/Saint Lawrence Seaway/New York State Waterways	
17	(50,53)	Washington Oregon Coast	Puget Sound to California-Oregon Line
18	(51,52)	Columbia-Snake Waterway/Willamette River	Lewiston to Mouth
19	(54-56)	California Coast	California-Oregon Line to Mexican Border
20	(57,59)	Alaska	
21	(60)	Hawaii and Pacific Territories	
22	(61)	Caribbean, including Puerto Rico and Virgin Islands	

NATIONAL WATERWAYS STUDY ANALYSIS SEGMENTS

Segment Number	Segment Name	Description*(see last page footnote)	PE Numbers
1	Upper Mississippi River	Minneapolis, Minnesota (including Black, St. Croix, and Minnesota Rivers) to L/D 26 (mile 208.0)	0306-0360
2	Lower Upper Missis-sippi River	L/D 26 to L/D 27 (mile 185.3)	0302,0304
3	Middle Mississippi River	L/D 27 to mouth of Ohio River (Cairo) including Kaskaskia River	0300,0301
4	Lower Middle Missis-sippi River	Mouth of Ohio River to mile 544.2 (including Wolf River)	0465-0485
5	Upper Lower Missis-sippi River	Mile 544.2 to Old River (mile 304.0)	0425-0460
6	Lower Mississippi River	Old River (mile 304.0) to mile 255.0	0420
7	Mississippi River - Baton Rouge, Louisiana	Mile 255.0 to mile 106.0	0410,0415
8	Mississippi River - New Orleans, Louisiana to Gulf	Mile 106.0 to Gulf (mile 0.0)	0400,0405

9	Illinois Waterway	Chicago, Illinois (Guard Lock) to Mouth of Illinois River (includes Cal-Sag and Sanitary Ship Canal)	0500-0540
10	Missouri River	Sioux City, Iowa to Mouth of Missouri River, (including Kansas River)	0100-0110
11	Upper Ohio River	Confluence (with Monongahela and Allegheny) to Gallipolis L & D including Muskingum River)	0250-0286
12	Middle Ohio River	Gallipolis L & D to Markland L & D (including Big Sandy River)	0236-0248
13	Lower Ohio River - Three	Markland L & D to L/D 47 (mile 777.7)	0222-0234
14	Lower Ohio River - Two	L/D 47 to Smithland L & D (mile 918.5)	0206-0220
15	Lower Ohio River - One	Smithland L & D to Mississippi River (Cairo)	0200-0204
16	Monongahela River	Head of navigation to Mouth	0700-0760
17	Allegheny River	Head of navigation to Mouth	0600-0640
18	Kanawha River	Head of navigation to Mouth	0800-0815
19	Kentucky River	Head of navigation to Mouth	0900-0970

20	Green River and Barren River	Head of navigation (of both) to Mouth (at Ohio River)	1000-1025, 1100,1105
21	Cumberland River	Head of navigation to Mouth at Ohio River, including Barkley Canal	1200-1230
22	Upper Tennessee River and Clinch River	Head of navigation to Pickwick L & D (mile 206.7)	1310-1375, 1400,1405
23	Lower Tennessee River to Ohio River	Pickwick L & D to Ohio River	1300,1305
24	Arkansas, Verdigris, White and Black Rivers	Heads of navigation to Mouth at Mississippi	1500-1585, 1700,1705
25	Ouachita-Black and Red Rivers	Camden, Arkansas to Mouth at Red River, Red River from Daingerfield, Texas to the Old River	1600-1620, 1905
26	Old and Atchafalaya River, Mississippi River to Morgan City	Old River, Atachafalaya River, Juntion with Old River to Junction with Port Allen-Morgan City Rte.	1900
27	Baton Rouge, Louisiana - Morgan City, Louisiana Bypass	Port Allen L. (mile 64.1) to Junction with Atachafalaya River (mile 2.5)	1800,1805

28	GIWW West (Eastern Section)(and tributaries)	Harvey Canal, Algiers Canal, GIWW West to Calcasieu L. (mile 238.9)	2700-2720, 2745
29	GIWW West (Middle Section)(and tributaries)	Calcasieu L. to mile 540.9	2725-2735
30	GIWW West (South Section)(and tributaries)	Mile 540.9 to end (mile 683.7)	2740
31	GIWW East (West Section) and Pearl River (and tributaries)	Pearl River below Bogalusa (mile 55.0), GIWW East to Mobile Bay (mile 133.6)	2000,2600
32	GIWW East (East Section)(and tributaries)	Mobile Bay to St. Marks, Florida (mile 425.0)	2605-2615
33	Florida Gulf Coast	St. Marks, Florida to Key West, Florida including Okeechobee Waterway	14600-14999
34	Houston Ship Canal	Head of navigation to Mouth at GIWW	2750
35	Black Warrior River	Head of navigation to Mobile (including harbor)	2100-2130,2620
36	Alabama-Coosa Rivers	Head of navigation to Mouth (at Alabama River)	2200-2215

37	Tennessee-Tombigbee Waterway	Tennessee River to Black Warrior confluence	None
38	Apalachicola, Chattahoochee, Flint Rivers	Heads of navigation to Mouth	2300,2400,2500-2510
39	Florida/Georgia Coast	Key West, Florida (inclusive of port complex) to Savannah River including AIWW and tributaries	13000-13515, 13535-14467, 16100-16599
40	Carolinas Coast	Savannah River to North Carolina/Virginia Boundary including AIWW and tributaries	10826-12350, 13516-13534
41	Chesapeake and Delaware Bays	North Carolina/Virginia Boundary to Cape May, New Jersey *(see footnote for detail)	04300-10815
42	New Jersey/New York Coast	Cape May, New Jersey to New York/Connecticut Boundary (including Hudson River, Waterford, New York to Mouth)	02000-03199, 03786-04299
43	New York State Waterways	New York State Barge Canal and Lake Champlain	03200-03785
44	Upper Atlantic	New York/Connecticut Boundary to St. Croix River, Maine	00001-01799

45	Lake Ontario and St. Lawrence Seaway (United States)	Atlantic Ocean to Buffalo	70000-70499, 71000-71499
46	Lake Erie (United States)	Buffalo (inclusion of port) to Mouth of Detroit River	72000-72499
47	Lake Huron (United States)	Includes St. Mary's and Detroit River	73000-73499, 74000-74499, 75000-75499, 76000-76499, 78000-78499
48	Lake Michigan	West of Mackinaw City, Michigan	77410-77999
49	Lake Superior (United States)	West of Soo Locks	79000-79499
50	Puget Sound	Head of navigation to Juan de Fuca Straits	91071-91571
51	Upper Columbia-Snake Waterway:	Asotin Dam, Washington to Bonneville Lock and Dam, Washington	90146-90290, 92000-92999, 94000-94745, 91600-91999, 91580-91592
52	Lower Columbia-Snake Waterway/Williamette River	Bonneville Lock and Dam, Washington to Mouth	)001-90145, 9 500-90699

53	Oregon/Washington Coast	Puget Sound to Oregon-California border	90000, 90880-90999, 91000-91050
54	Northern California	Oregon-California border to Mouth of San Francisco Bay	82401-82999
55	San Francisco Bay Area	Includes San Francisco Bay Area and the Sacramento River and tributaries and San Joaquin River and tributaries	81050-81726, 82202-82400
56	Central/South California	Mouth of San Francisco Bay to Mexico border	80000-80870, 82000-82170
57	Southeast Alaska (Panhandle)	Includes both intrasegment routes and routes between segment and CONUS	93000-93065
58	South Central Alaska Coast (excludes Aleutians)	Includes both intrasegment routes and routes between segment and CONUS	93127-93182, 93520
59	West and North Coasts of Alaska including Aleutians	Includes both intrasegment routes and routes between segment and CONUS	93268-93460, 93568-93710
60	Western Pacific, including Hawaii, Guam and American Samoa	Includes both intrasegment routes and routes between segment and CONUS	84000-85000

61	Carribean, including Puerto Rico and Virgin Islands	Includes both intrasegment routes and routes between segment and CONUS	17000-17900
62	Rest of World	Overseas (including British Columbia West Coast)/Canadian Great Lakes	99999, 99905-99980, 70500-70999, 71500-71999, 72500-72999, 73500-73999, 74500-74999, 75500-75999, 76500-76999, 78500-78999

APPENDIX B

WATERBORNE DEMAND PROJECTIONS FOR ALTERNATIVE NWS MACROECONOMIC SCENARIOS

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WATERBORNE DEMAND PROJECTION

NWS MACROECONOMIC SCENARIO

BADENERGY2003A

4/21/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY All Commodities
ALTERNATIVE Badenergy2003A

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77 90	90 03
Upper Mississippi	Shipped	20,619	28,736	36,420	43,206	48,275	47,667	55,103	5.9	1.9
	Received	16,474	18,830	20,982	24,832	27,367	29,371	30,128	3.2	1.5
Lower Upper Mississippi	Shipped	23,149	25,067	28,700	35,247	40,423	43,774	46,482	3.3	2.2
	Received	9,042	9,192	11,056	16,970	21,761	26,529	28,270	5.0	4.0
Lower Mississippi	Shipped	11,136	12,864	13,888	14,349	16,272	13,898	17,065	2.0	1.3
	Received	24,819	24,512	25,404	26,940	28,410	29,831	30,628	0.6	1.0
Baton Rouge to Gulf	Shipped	84,271	85,848	89,057	97,329	100,094	105,827	109,845	1.1	0.9
	Received	99,444	129,089	152,553	186,509	205,393	219,047	250,770	5.0	2.3
Illinois River	Shipped	32,515	35,638	42,719	47,212	48,951	50,391	58,147	2.9	1.6
	Received	31,245	34,840	38,260	42,480	45,982	49,997	52,425	2.4	1.6
Missouri River	Shipped	5,612	6,110	6,348	6,277	6,122	5,906	5,752	0.9	-0.7
	Received	4,635	4,627	4,305	3,978	3,854	3,849	3,698	-1.2	-0.6
Ohio River	Shipped	140,247	145,675	173,051	205,918	237,799	264,672	279,653	3.0	2.4
	Received	134,112	138,022	160,217	174,228	189,514	204,157	212,010	2.0	1.5
Tennessee River	Shipped	10,493	10,675	11,060	12,716	18,067	21,135	22,934	1.5	4.6
	Received	17,457	17,583	17,978	20,847	23,945	27,267	29,371	1.4	2.7
Arkansas River	Shipped	6,636	6,891	7,094	9,238	11,315	12,296	13,235	2.6	2.8
	Received	6,816	6,832	6,816	6,579	6,471	6,578	6,484	0.3	-0.1
Gulf Coast West	Shipped	148,122	148,878	144,084	153,876	159,699	167,958	174,716	0.3	1.0
	Received	75,159	95,138	97,731	117,382	123,030	143,800	154,920	3.5	2.2
Gulf Coast East	Shipped	32,236	32,401	37,811	42,293	47,252	52,140	54,566	2.1	2.0
	Received	38,641	38,001	43,344	51,157	57,908	63,301	65,517	2.2	1.9
Warrior River System	Shipped	23,871	24,892	27,552	34,901	36,001	39,722	43,954	3.0	1.8
	Received	20,413	21,599	23,539	29,894	34,819	39,838	45,256	3.0	3.2
South Atlantic Coast	Shipped	12,464	11,856	10,866	11,022	10,471	10,734	11,249	-0.9	0.2
	Received	37,490	36,815	35,474	35,908	35,560	36,295	37,111	-0.3	0.3
Middle Atlantic Coast	Shipped	159,990	162,738	166,113	168,813	169,511	171,115	173,192	0.4	0.2
	Received	181,200	183,257	176,026	178,964	179,915	181,754	184,203	-0.1	0.2

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SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
North Atlantic Coast	Shipped	9,914	10,372	10,291	10,004	9,400	8,754	8,431	0.1	-1.3
	Received	50,273	51,169	48,229	49,328	48,256	47,044	46,381	0.1	0.5
Great Lakes and Seaway	Shipped	109,590	147,188	161,031	175,059	193,880	215,063	228,743	3.7	2.1
	Received	107,660	143,209	156,810	170,049	188,553	208,994	221,937	3.6	2.1
Washington/Oregon Coast	Shipped	22,600	24,403	24,457	25,656	25,906	26,550	26,867	1.0	0.4
	Received	24,992	35,906	55,577	59,365	61,499	58,825	56,649	6.9	-0.4
Columbia-Snake Willamette River	Shipped	22,406	27,074	27,974	29,474	28,694	28,204	27,302	2.1	0.6
	Received	25,848	31,310	32,388	33,994	33,039	32,307	31,259	2.1	-0.6
California Coast	Shipped	43,257	37,892	41,135	44,658	43,892	43,108	43,210	0.2	0.3
	Received	50,472	71,489	72,368	70,821	63,239	53,689	47,102	2.6	-3.1
Alaska	Shipped	19,485	89,397	101,746	114,392	114,748	115,226	115,582	14.6	0.1
	Received	8,077	7,075	7,549	8,225	8,693	9,268	9,646	2.4	1.2
Hawaii and Pacific Territories	Shipped	5,412	5,572	6,364	7,150	7,810	8,656	9,284	2.2	2.0
	Received	6,230	7,277	8,236	9,166	10,008	11,080	11,883	3.0	2.0
Domestic Caribbean	Shipped	32,405	33,806	35,892	38,225	39,750	40,995	41,928	1.3	0.7
	Received	7,931	8,201	8,810	9,399	10,114	10,973	11,592	1.3	1.6
Total	Shipped	976,428	1,113,973	1,203,652	1,327,016	1,412,333	1,493,792	1,567,240	2.4	1.3
	Received	976,428	1,113,973	1,203,652	1,327,016	1,412,333	1,493,792	1,567,240	2.4	1.3

* = less than 500 tons

4/21/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY All Commodities
ALTERNATIVE Badenergy2003A

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	59,920	75,922	96,733	106,887	112,900	109,259	134,953	4.6	1.8
	Imports	97,255	110,023	121,790	112,278	109,420	105,506	102,482	1.1	-0.7
Illinois River	Exports	2,571	4,571	5,751	6,355	6,531	6,600	8,219	7.2	2.0
	Imports	3,573	2,670	3,239	3,603	3,934	4,316	4,565	0.1	1.8
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	35,406	47,348	54,675	60,950	62,306	63,337	65,870	4.3	0.6
	Imports	137,104	155,449	171,140	155,123	148,441	139,894	133,552	1.0	-1.1
Gulf Coast East	Exports	22,089	25,035	29,784	25,287	21,591	18,010	16,424	1.0	-3.3
	Imports	17,812	20,033	21,725	20,881	20,517	20,154	19,926	1.2	-0.4
Warrior River System	Exports	5,521	7,166	9,553	10,953	13,185	12,915	15,962	5.4	2.9
	Imports	8,167	8,962	9,720	12,234	13,997	16,539	18,419	3.2	3.2
South Atlantic Coast	Exports	8,618	10,260	12,433	13,029	13,930	14,885	15,956	3.2	1.6
	Imports	20,701	18,837	18,815	19,440	18,731	18,498	18,643	-0.5	-0.3
Middle Atlantic Coast	Exports	56,757	63,129	77,457	86,507	91,958	98,589	110,211	3.3	1.9
	Imports	168,692	158,922	164,033	171,023	172,688	175,890	179,293	0.1	0.4

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SEGMENT	EXP/IMP*	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77 90	90 03
North Atlantic Coast	Exports	1,307	1,656	2,055	2,129	2,211	2,309	2,378	3.8	0.9
	Imports	33,997	27,441	34,262	39,776	40,514	41,754	43,684	1.2	0.7
Great Lakes and Seaway	Exports	33,765	44,459	55,562	63,120	67,542	71,425	77,870	4.9	1.6
	Imports	29,255	29,063	32,350	35,052	38,324	42,285	45,088	1.4	2.0
Washington/Oregon Coast	Exports	18,060	20,974	23,917	23,337	22,694	23,683	25,765	2.0	0.8
	Imports	20,019	12,560	34,121	39,787	45,829	48,275	49,682	5.4	1.7
Columbia-Snake Willamette River	Exports	12,821	15,978	19,266	20,433	19,286	18,097	16,836	3.6	-1.5
	Imports	4,045	3,734	4,322	4,904	5,819	6,830	7,527	1.5	3.4
California Coast	Exports	15,982	19,877	22,456	24,132	25,003	26,744	28,586	3.2	1.3
	Imports	60,187	26,431	29,527	32,634	35,946	40,253	43,254	-4.6	2.2
Alaska	Exports	5,024	3,321	3,162	3,003	2,946	2,926	2,942	-3.9	-0.2
	Imports	1,619	1,391	1,427	1,487	1,556	1,645	1,703	0.6	1.0
Hawaii and Pacific Territories	Exports	147	153	176	188	202	221	235	1.9	1.7
	Imports	5,926	4,626	4,507	4,616	4,459	4,373	4,382	-1.9	-0.4
Domestic Caribbean	Exports	1,463	2,046	1,808	1,818	1,915	2,027	2,097	1.7	1.1
	Imports	51,645	52,014	54,169	57,123	57,509	57,816	58,171	0.8	0.1
Total	Exports	279,451	341,895	414,787	448,128	464,201	471,027	524,303	3.7	1.2
	Imports	659,998	632,157	705,146	709,961	717,684	724,028	730,371	0.6	0.2

* = less than 500 tons

4/21/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL, AND THROUGH

COMMODITY All Commodities
ALTERNATIVE Badenergy2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	30,874	40,118	48,479	56,669	60,616	63,300	71,229	4.8	1.8
Lower Upper Mississippi	77,493	91,558	110,681	130,878	143,039	153,750	174,054	4.1	2.2
Lower Mississippi	123,602	140,481	167,162	202,494	233,142	251,961	284,630	3.9	2.7
Baton Rouge to Gulf	187,257	218,317	247,758	296,307	329,840	357,569	397,323	3.6	2.3
Illinois River	54,342	61,523	71,274	78,613	83,258	88,540	98,827	2.9	1.8
Missouri River	6,735	7,297	7,430	7,453	7,370	7,244	7,143	0.8	-0.3
Ohio River	172,739	179,209	210,315	247,244	286,569	319,348	338,195	2.8	2.4
Tennessee River	22,056	22,397	23,375	27,172	34,699	40,093	43,453	1.6	3.7
Arkansas River	9,396	9,699	10,205	12,614	14,797	16,003	17,065	2.3	2.4
Gulf Coast West	168,762	188,532	182,374	206,210	219,064	238,554	252,815	1.6	1.6
Gulf Coast East	69,061	68,777	79,148	89,883	103,258	114,026	119,778	2.0	2.2
Warrior River System	30,006	31,123	34,038	41,890	47,983	54,052	60,025	2.6	2.8
Great Lakes	115,807	154,218	168,310	182,258	201,569	223,197	237,077	3.6	2.0

a = less than 500 tons

4.21/80

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON-MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY: All Commodities
ALTERNATIVE: Badenergy2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	10,153	13,386	16,193	18,646	19,678	20,508	23,525	4.8	1.8
Lower Upper Mississippi	13,960	16,858	20,531	23,811	25,550	27,113	31,111	4.2	2.1
Lower Mississippi	71,393	82,662	100,330	123,129	142,311	155,096	175,985	4.3	2.8
Baton Rouge to Gulf	20,845	24,860	28,089	33,629	37,664	41,079	45,833	3.7	2.4
Illinois River	8,005	9,178	10,646	11,698	12,427	13,268	14,852	3.0	1.9
Missouri River	1,990	2,297	2,446	2,618	2,652	2,627	2,656	2.1	0.1
Ohio River	41,386	43,585	52,467	65,476	77,660	88,518	94,621	3.6	2.9
Tennessee River	3,602	3,745	3,997	4,585	5,830	6,706	7,250	1.9	3.6
Arkansas River	1,398	1,471	1,640	2,264	2,788	3,078	3,352	3.8	3.1
Gulf Coast West	18,800	19,668	20,315	22,795	24,341	26,361	27,765	1.5	1.5
Gulf Coast East	4,697	4,658	5,113	5,830	7,121	7,932	8,391	1.7	2.8
Warrior River System	4,686	4,987	5,547	7,332	7,695	8,666	9,829	3.5	2.3
Great Lakes	56,759	80,707	87,827	95,077	105,822	118,142	126,374	4.0	2.2
Total	257,673	308,062	355,145	416,840	471,542	519,094	571,542	3.8	2.5

* = less than 500,000 ton-miles

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY Farm Products
ALTERNATIVE Badenergy2003A

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Shipped	11,547	17,969	23,604	26,379	26,858	26,808	34,075	6.6	2.0
	Received	43	44	44	45	45	46	46	0.3	0.3
Lower Upper Mississippi	Shipped	3,046	3,827	4,645	4,910	5,354	4,566	6,089	3.8	1.6
	Received	279	292	291	313	319	334	343	0.9	0.7
Lower Mississippi	Shipped	4,370	5,614	6,099	5,963	7,639	5,019	8,475	2.4	2.7
	Received	694	698	698	706	708	714	717	0.1	0.1
Baton Rouge to Gulf	Shipped	837	841	844	851	856	865	870	0.1	0.2
	Received	37,781	50,372	65,045	71,498	75,187	70,962	94,183	5.0	2.1
Illinois River	Shipped	14,941	17,469	23,286	26,095	26,445	26,954	34,512	4.4	2.2
	Received	154	155	155	155	155	156	156	0.0	0.0
Missouri River	Shipped	1,223	1,633	1,963	2,147	2,134	1,969	2,119	4.4	0.1
	Received	6	6	6	6	6	6	6	0.0	0.0
Ohio River	Shipped	4,292	5,414	6,932	7,563	8,025	7,510	10,095	4.5	2.2
	Received	197	202	201	208	211	216	218	0.4	0.4
Tennessee River	Shipped	218	160	176	178	202	171	237	-1.5	2.2
	Received	1,462	1,474	1,474	1,494	1,500	1,514	1,522	0.2	0.1
Arkansas River	Shipped	1,034	1,204	1,256	1,193	1,506	972	1,606	1.1	2.3
	Received	7	7	7	7	7	7	7	0.0	0.0
Gulf Coast West	Shipped	552	604	613	701	740	815	860	1.9	1.6
	Received	271	314	313	385	406	458	487	2.7	1.8
Gulf Coast East	Shipped	208	219	223	242	253	272	283	1.2	1.2
	Received	740	744	749	756	765	775	783	0.2	0.3
Warrior River System	Shipped	730	1,423	1,521	1,412	1,980	1,215	2,336	5.2	4.0
	Received	975	1,666	1,760	1,648	2,210	1,438	2,555	4.1	3.4
South Atlantic Coast	Shipped	107	111	116	122	130	140	147	1.0	1.4
	Received	9	11	12	14	17	20	22	3.3	3.6
Middle Atlantic Coast	Shipped	574	607	652	710	781	872	937	1.6	2.2
	Received	484	512	551	599	661	738	794	1.7	2.2

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4/16/80

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77 90	90 03
North Atlantic Coast	Shipped	6	7	8	9	11	13	15	3.3	3.6
	Received	2	2	3	3	4	5	5	3.3	3.6
Great Lakes and Seaway	Shipped	1,475	1,530	1,530	1,530	1,530	1,530	1,530	0.3	0.0
	Received	1,475	1,530	1,530	1,530	1,530	1,530	1,530	0.3	0.0
Washington/Oregon Coast	Shipped	65	72	81	92	107	125	139	2.8	3.2
	Received	2	3	3	4	4	5	6	3.3	3.3
Columbia-Snake Willamette River	Shipped	3,460	5,512	7,218	8,321	7,749	7,037	6,292	7.0	-2.1
	Received	3,425	5,476	7,180	8,282	7,707	6,991	6,244	7.0	-2.1
California Coast	Shipped	264	295	339	393	461	547	610	3.1	3.4
	Received	73	80	89	100	114	131	144	2.4	2.9
Alaska	Shipped	1	1	1	1	1	1	1	3.3	3.6
	Received	40	45	52	60	71	85	95	3.2	3.5
Hawaii and Pacific Territories	Shipped	389	438	506	591	698	833	931	3.3	3.6
	Received	520	582	667	774	908	1,078	1,201	3.1	3.4
Domestic Caribbean	Shipped	77	79	83	88	93	101	106	1.0	1.5
	Received	776	814	868	935	1,019	1,126	1,203	1.4	2.0
Total	Shipped	49,416	65,028	81,696	89,520	93,554	88,335	112,266	4.7	1.8
	Received	49,416	65,028	81,696	89,520	93,554	88,335	112,266	4.7	1.8

a = less than 500 tons

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY Farm Products
ALTERNATIVE Badenergy2003A

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	43,064	55,431	72,005	79,150	83,839	79,018	105,727	4.8	2.3
	Imports	236	246	250	255	260	264	267	0.6	0.4
Illinois River	Exports	1,353	3,273	4,434	4,986	5,130	5,161	6,789	10.6	2.4
	Imports	3	3	3	3	3	3	3	0.6	0.4
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	20,738	29,564	37,993	44,548	45,641	46,283	48,531	6.1	0.7
	Imports	313	327	332	339	345	351	355	0.6	0.4
Gulf Coast East	Exports	2,751	2,688	3,544	4,178	4,451	4,871	5,804	3.3	2.6
	Imports	709	739	751	766	782	795	803	0.6	0.4
Warrior River System	Exports	1,317	2,879	3,186	3,100	4,250	2,813	5,130	6.8	4.0
	Imports	67	70	71	72	74	75	76	0.6	0.4
South Atlantic Coast	Exports	691	1,005	1,239	1,420	1,622	1,675	2,088	5.7	3.0
	Imports	441	460	467	477	486	494	499	0.6	0.4
Middle Atlantic Coast	Exports	13,055	17,219	23,471	26,701	27,141	27,769	35,252	5.7	2.2
	Imports	1,944	2,027	2,058	2,102	2,143	2,179	2,202	0.6	0.4

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
North Atlantic Coast	Exports	76	86	104	129	152	178	195	4.1	3.2
	Imports	22	23	23	23	24	24	25	0.6	0.4
Great Lakes and Seaway	Exports	9,610	14,202	18,528	21,124	21,740	21,411	25,167	6.2	1.4
	Imports	135	139	141	143	145	147	148	0.4	0.3
Washington/Oregon Coast	Exports	1,626	5,887	8,369	9,820	8,577	10,471	12,514	14.8	1.9
	Imports	16	16	17	17	17	18	18	0.6	0.4
Columbia Snake Willamette River	Exports	6,521	10,233	13,394	15,489	14,603	13,472	12,235	6.9	-1.8
	Imports	5	5	6	6	6	6	6	0.6	0.4
California Coast	Exports	3,236	6,026	7,940	9,516	10,004	11,113	12,484	8.7	2.1
	Imports	575	600	609	622	634	645	651	0.6	0.4
Alaska	Exports	a	a	a	a	a	a	a	4.1	3.2
	Imports	6	6	6	6	6	6	6	0.1	0.1
Hawaii and Pacific Territories	Exports	3	3	4	4	5	6	7	4.1	3.2
	Imports	2	2	2	2	3	3	3	0.6	0.4
Domestic Caribbean	Exports	17	19	23	29	34	39	43	4.0	3.2
	Imports	129	132	133	134	135	136	137	0.3	0.2
Total	Exports	104,059	148,510	194,233	220,193	227,990	224,279	271,965	5.9	1.6
	Imports	4,603	4,796	4,867	4,968	5,064	5,146	5,199	0.6	0.4

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL, AND THROUGH

COMMODITY: Farm Products
ALTERNATIVE: Badenergy2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	11,558	17,980	23,615	26,390	26,869	26,819	34,086	6.6	2.0
Lower Upper Mississippi	30,632	40,771	51,373	59,433	60,663	60,169	76,666	5.2	2.0
Lower Mississippi	38,711	51,298	65,973	72,419	76,106	71,880	95,100	4.3	2.[illegible]
Baton Rouge to Gulf	39,145	51,755	66,433	72,918	76,622	72,426	95,664	4.9	2.1
Illinois River	14,982	17,510	23,327	26,136	26,486	26,995	34,553	4.4	2.2
Missouri River	1,229	1,639	1,969	2,153	2,141	1,975	2,125	4.4	-0.1
Ohio River	5,965	7,044	8,578	9,237	9,730	9,203	11,865	3.4	1.9
Tennessee River	1,663	1,616	1,632	1,654	1,683	1,666	1,740	0.0	0.4
Arkansas River	1,040	1,210	1,262	1,200	1,513	979	1,613	1.1	2.3
Gulf Coast West	697	767	775	892	939	1,035	1,092	1.9	1.6
Gulf Coast East	1,285	1,303	1,312	1,341	1,361	1,392	1,413	0.3	0.4
Warrior River System	1,162	1,857	1,955	1,848	2,417	1,653	2,775	3.6	3.2
Great Lakes	1,475	1,530	1,530	1,530	1,530	1,530	1,530	0.3	0.0

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON MILES
MISSISSIPPI RIVER SYSTEM GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY Farm Products
ALTERNATIVE Badenergy2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	4,569	7,112	9,343	10,441	10,831	10,611	13,488	6.6	2.0
Lower Upper Mississippi	6,456	8,618	11,319	12,619	12,865	12,797	16,313	5.3	2.0
Lower Mississippi	25,576	34,009	44,182	48,792	50,820	48,722	63,847	5.1	2.1
Baton Rouge to Gulf	4,993	6,574	8,446	9,283	9,717	9,223	12,097	4.9	2.1
Illinois River	2,601	3,042	4,057	4,548	4,609	4,698	6,017	4.4	2.2
Missouri River	590	786	945	1,033	1,027	948	1,020	4.4	0.1
Ohio River	1,422	1,747	2,234	2,448	2,568	2,452	3,226	4.3	2.1
Tennessee River	596	597	597	604	610	610	622	0.1	0.2
Arkansas River	237	275	287	273	344	223	367	1.1	2.3
Gulf Coast West	115	125	125	141	146	159	165	1.6	1.2
Gulf Coast East	96	98	98	102	103	106	108	0.5	0.5
Warrior River System	84	168	179	165	234	140	275	5.3	4.0
Great Lakes	1,217	1,255	1,255	1,255	1,255	1,255	1,255	0.2	0.0
Total	48,551	64,406	83,067	91,704	94,930	91,943	118,801	5.0	2.0

a = less than 500,000 ton-miles

4/21/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY Metallic Ores
ALTERNATIVE Badenergy2003A

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Shipped	13	14	15	16	17	18	19	1.6	1.3
	Received	18	19	21	22	24	25	26	1.6	1.3
Lower Upper Mississippi	Shipped	31	33	36	38	41	43	45	1.6	1.3
	Received	43	45	49	51	54	57	59	1.3	1.1
Lower Mississippi	Shipped	1	2	2	2	2	2	2	1.6	1.3
	Received	92	97	106	113	120	128	133	1.6	1.3
Baton Rouge to Gulf	Shipped	2,377	2,483	2,705	2,886	3,084	3,353	3,545	1.5	1.6
	Received	95	100	109	116	122	130	136	1.5	1.3
Illinois River	Shipped	69	69	70	71	71	72	73	0.2	0.2
	Received	4,470	7,438	8,010	8,772	9,606	10,781	11,678	5.3	2.2
Missouri River	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Shipped	248	260	284	301	319	339	353	1.5	1.2
	Received	1,108	1,150	1,251	1,343	1,452	1,614	1,736	1.5	2.0
Tennessee River	Shipped	16	17	19	20	21	23	24	1.6	1.3
	Received	465	489	535	569	603	643	670	1.6	1.3
Arkansas River	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	755	795	869	924	980	1,045	1,089	1.6	1.3
Gulf Coast West	Shipped	78	82	90	96	101	108	113	1.6	1.3
	Received	105	110	119	125	132	139	144	1.3	1.1
Gulf Coast East	Shipped	121	128	140	149	157	168	175	1.6	1.3
	Received	62	65	71	76	80	86	89	1.6	1.3
Warrior River System	Shipped	3,693	3,737	3,985	5,714	6,975	8,726	10,083	3.4	4.5
	Received	3,716	3,760	4,007	5,735	6,996	8,746	10,103	3.4	4.5
South Atlantic Coast	Shipped	434	446	475	686	840	1,053	1,219	3.6	4.5
	Received	501	514	543	753	907	1,120	1,286	3.2	4.2
Middle Atlantic Coast	Shipped	71	71	71	71	71	71	71	0.0	0.0
	Received	3	3	3	3	3	3	3	0.0	0.0

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SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	0	0	0	0	0	0	0	0.0	0.0
Great Lakes and Seaway	Shipped	45,198	71,264	77,541	85,277	94,796	106,701	115,468	5.0	2.4
	Received	40,917	64,021	69,719	76,723	85,417	96,158	104,036	5.0	2.4
Washington/Oregon Coast	Shipped	*	*	*	*	*	*	*	0.0	0.0
	Received	*	*	*	*	*	*	*	0.0	0.0
Columbia Snake Willamette River	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	0	0	0	0	0	0	0	0.0	0.0
California Coast	Shipped	*	*	*	*	*	*	*	0.0	0.0
	Received	*	*	*	*	*	*	*	0.0	0.0
Alaska	Shipped	*	*	*	*	*	*	*	0.0	0.0
	Received	*	*	*	*	*	*	*	0.0	0.0
Hawaii and Pacific Territories	Shipped	*	*	*	*	*	*	*	0.0	0.0
	Received	*	*	*	*	*	*	*	0.0	0.0
Domestic Caribbean	Shipped	*	*	*	*	*	*	*	0.0	0.0
	Received	*	*	*	*	*	*	*	0.0	0.0
Total	Shipped	52,361	78,615	85,442	95,335	106,504	120,685	131,198	4.7	2.5
	Received	52,361	78,615	85,442	95,335	106,504	120,685	131,198	4.7	2.5

* = less than 500 tons

4/21/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY Metallic Ores
ALTERNATIVE Badenergy2003A

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	97	102	111	121	132	143	150	1.7	1.7
	Imports	8,049	8,391	9,437	10,208	11,011	12,086	12,847	1.8	1.8
Illinois River	Exports	*	*	*	*	1	1	1	1.7	1.7
	Imports	1,239	993	1,074	1,176	1,287	1,443	1,562	-0.4	2.2
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	9	9	10	11	12	13	13	1.7	1.6
	Imports	8,047	8,370	9,391	10,576	11,636	13,045	14,069	2.1	2.2
Gulf Coast East	Exports	112	118	128	139	151	164	173	1.7	1.7
	Imports	204	213	240	260	280	307	325	1.9	1.7
Warrior River System	Exports	1	1	1	2	2	2	2	1.7	1.7
	Imports	6,683	8,838	7,442	9,766	11,524	13,946	15,801	3.0	3.8
South Atlantic Coast	Exports	38	40	43	47	51	55	58	1.7	1.7
	Imports	1,144	1,177	1,294	1,615	1,866	2,210	2,470	2.7	3.3
Middle Atlantic Coast	Exports	170	129	140	153	166	180	189	0.8	1.7
	Imports	14,439	11,115	12,815	13,733	16,089	18,079	19,338	0.4	2.7

4/21/80

SEGMENT	EXP/IMP	YEARS 1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Exports	1	1	1	1	1	1	1	1.7	1.7
	Imports	13	13	15	16	18	19	21	1.9	1.7
Great Lakes and Seaway	Exports	2,396	3,584	3,597	3,611	3,627	3,644	3,655	3.2	0.1
	Imports	18,073	17,300	18,951	20,851	23,314	26,359	28,582	1.1	2.5
Washington/Oregon Coast	Exports	1	1	1	1	1	1	1	1.7	1.7
	Imports	114	119	135	146	157	172	182	1.9	1.7
Columbia-Snake Willamette River	Exports	a	a	a	a	a	a	a	1.7	1.7
	Imports	85	126	146	159	178	200	215	4.9	2.4
California Coast	Exports	58	62	67	73	79	85	89	1.7	1.6
	Imports	349	626	738	798	910	1,035	1,118	6.6	2.6
Alaska	Exports	460	484	526	572	621	675	710	1.7	1.7
	Imports	a	a	a	a	a	a	a	0.0	0.0
Hawaii and Pacific Territories	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Domestic Caribbean	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	1,147	1,198	1,354	1,465	1,579	1,726	1,829	1.9	1.7
Total	Exports	3,343	4,531	4,627	4,730	4,843	4,965	5,043	2.7	0.5
	Imports	59,586	56,478	63,031	70,770	79,851	90,627	98,360	1.3	2.6

a = less than 500 tons

4/21/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL, AND THROUGH

COMMODITY Metallic Ores
ALTERNATIVE Badenergy2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	31	33	36	38	41	43	45	1.6	1.3
Lower Upper Mississippi	252	265	290	308	325	347	361	1.5	1.2
Lower Mississippi	2,510	2,625	2,865	3,059	3,270	3,554	3,757	1.5	1.6
Baton Rouge to Gulf	2,665	2,786	3,037	3,239	3,458	3,751	3,960	1.5	1.6
Illinois River	4,584	7,559	8,142	8,912	9,755	10,940	11,844	5.2	2.2
Missouri River	0	0	0	0	0	0	0	0.0	0.0
Ohio River	1,641	1,710	1,863	1,993	2,140	2,348	2,500	1.5	1.8
Tennessee River	471	496	542	577	611	652	679	1.6	1.3
Arkansas River	755	795	869	924	980	1,045	1,089	1.6	1.3
Gulf Coast West	181	190	206	218	230	244	254	1.4	1.2
Gulf Coast East	254	265	287	304	320	339	352	1.4	1.1
Warrior River System	3,742	3,787	4,037	5,767	7,029	8,782	10,140	3.4	4.4
Great Lakes	45,299	71,370	77,657	85,400	94,927	106,840	115,614	5.0	2.4

a = less than 500 tons

4/21/80

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY Metallic Ores
ALTERNATIVE Hadenergy2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	11	11	12	13	14	15	15	1.6	1.3
Lower Upper Mississippi	53	55	60	64	68	72	75	1.5	1.2
Lower Mississippi	1,469	1,534	1,674	1,789	1,915	2,089	2,214	1.5	1.7
Baton Rouge to Gulf	288	301	328	350	373	404	427	1.5	1.5
Illinois River	145	222	239	261	284	317	341	4.6	2.1
Missouri River	0	0	0	0	0	0	0	0.0	0.0
Ohio River	1,003	1,045	1,145	1,226	1,319	1,460	1,565	1.6	1.9
Tennessee River	56	59	65	69	73	78	81	1.6	1.3
Arkansas River	90	95	103	110	117	124	129	1.6	1.3
Gulf Coast West	37	38	42	45	47	50	52	1.5	1.2
Gulf Coast East	12	12	13	13	14	15	15	1.1	0.9
Warrior River System	1,354	1,370	1,460	2,096	2,560	3,203	3,702	3.4	4.5
Great Lakes	33,507	52,552	57,260	62,963	70,116	78,966	85,460	5.0	2.4
Total	38,023	57,294	62,403	68,999	78,900	86,795	94,079	4.7	2.4

* = less than 500,000 ton-miles

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY Coal
ALTERNATIVE Badenergy2003A

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77 90	90 03
Upper Mississippi	Shipped	2,314	3,503	5,078	8,807	11,316	12,619	13,162	10.8	3.1
	Received	6,840	8,398	10,310	13,785	16,007	16,804	17,274	5.5	1.7
Lower Upper Mississippi	Shipped	7,446	7,820	9,997	15,580	19,927	23,539	25,034	5.8	3.7
	Received	2,018	2,051	3,686	9,472	13,963	18,257	19,780	12.6	5.8
Lower Mississippi	Shipped	5	5	6	7	8	8	8	3.3	1.3
	Received	4,244	3,957	4,258	5,246	6,349	7,218	7,693	1.6	3.0
Baton Rouge to Gulf	Shipped	2,911	2,789	3,334	4,055	3,365	3,484	3,527	2.6	-1.1
	Received	3,445	4,616	7,296	20,560	30,879	39,720	43,252	14.7	5.9
Illinois River	Shipped	7,457	7,968	9,346	11,178	12,574	13,393	13,766	3.2	1.6
	Received	6,138	6,404	8,296	10,984	12,700	13,637	14,074	4.6	1.9
Missouri River	Shipped	1	2	2	3	3	3	3	4.6	1.9
	Received	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Shipped	98,828	103,217	129,708	163,527	194,449	219,737	232,320	3.9	2.7
	Received	83,043	86,697	107,821	121,455	134,616	145,238	151,626	3.0	1.7
Tennessee River	Shipped	4,079	4,172	4,462	6,131	11,324	14,223	16,118	3.2	7.7
	Received	7,435	7,395	7,147	9,531	11,960	14,405	15,995	1.9	4.1
Arkansas River	Shipped	515	649	1,124	3,791	5,800	7,469	8,041	16.6	6.0
	Received	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Shipped	a	a	a	a	a	a	a	10.1	5.7
	Received	261	322	797	4,591	7,427	9,795	10,519	24.7	6.6
Gulf Coast East	Shipped	692	1,030	2,271	4,938	8,691	10,764	11,511	16.3	6.7
	Received	8,063	7,562	12,535	20,130	26,997	31,908	33,674	7.3	4.0
Warrior River System	Shipped	7,821	8,063	10,274	15,707	14,808	17,186	18,720	5.5	1.4
	Received	7,118	7,545	9,092	13,783	16,722	20,409	23,171	5.2	4.1
South Atlantic Coast	Shipped	a	a	a	a	a	a	a	2.6	2.7
	Received	2	2	2	2	2	2	2	0.0	0.0
Middle Atlantic Coast	Shipped	5,034	8,339	15,838	20,163	27,323	33,973	38,406	11.1	5.1
	Received	5,026	8,331	14,331	17,155	24,315	30,965	35,398	9.9	5.7

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77 90	90 03
North Atlantic Coast	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	a	a	1,500	3,000	3,000	3,000	3,000	155.7	0.0
Great Lakes and Seaway	Shipped	19,145	25,014	25,729	24,395	27,864	30,844	32,028	1.9	2.1
	Received	22,615	29,288	30,097	28,588	32,514	35,885	37,225	1.8	2.1
Washington/Oregon Coast	Shipped	37	37	37	37	37	37	37	0.0	0.0
	Received	1	1	1	1	1	1	1	0.0	0.0
Columbia-Snake Willamette River	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	0	0	0	0	0	0	0	0.0	0.0
California Coast	Shipped	a	a	a	a	a	a	a	0.0	0.0
	Received	1	1	1	1	1	1	1	0.0	0.0
Alaska	Shipped	11	11	11	11	11	11	11	0.0	0.0
	Received	46	46	46	46	46	46	46	0.0	0.0
Hawaii and Pacific Territories	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	a	a	a	a	a	a	a	0.0	0.0
Domestic Caribbean	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	a	a	a	a	a	a	a	0.0	0.0
Total	Shipped	156,296	172,618	217,216	278,330	337,500	387,291	412,692	4.5	3.1
	Received	156,296	172,618	217,216	278,330	337,500	387,291	412,692	4.5	3.1

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY Coal
ALTERNATIVE Badenergy2003A

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77 90	90 03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	1,313	1,260	3,760	5,537	6,809	8,202	9,101	11.7	3.9
	Imports	142	252	260	284	277	287	287	5.5	0.1
Illinois River	Exports	12	16	20	23	26	28	30	5.3	1.8
	Imports	0	0	0	0	0	0	0	0.0	0.0
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	18	18	18	18	18	18	18	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast East	Exports	125	125	125	125	125	125	125	0.0	0.0
	Imports	219	385	398	434	425	439	439	5.4	0.1
Warrior River System	Exports	3,612	3,569	5,540	6,940	7,943	9,040	9,748	5.2	2.6
	Imports	866	1,526	1,580	1,721	1,684	1,741	1,741	5.4	0.1
South Atlantic Coast	Exports	1	1	1	1	1	1	1	0.0	0.0
	Imports	a	1	1	1	1	1	1	5.4	0.1
Middle Atlantic Coast	Exports	31,986	34,867	37,397	41,328	44,143	47,224	49,211	2.0	1.4
	Imports	306	536	555	605	592	612	612	5.4	0.1

4/16/80

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Great Lakes and Seaway	Exports	16,868	21,161	26,906	30,988	33,912	37,113	39,176	4.8	1.8
	Imports	19	33	35	38	37	38	38	5.4	0.1
Washington/Oregon Coast	Exports	a	a	a	a	a	a	a	0.0	0.0
	Imports	13	21	22	24	23	24	24	4.9	0.1
Columbia-Snake Willamette River	Exports	a	a	a	a	a	a	a	0.0	0.0
	Imports	a	a	a	a	a	a	a	5.0	0.1
California Coast	Exports	1	1	1	1	1	1	1	0.0	0.0
	Imports	157	276	285	311	304	315	315	5.4	0.1
Alaska	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Hawaii and Pacific Territories	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Domestic Caribbean	Exports	a	a	a	a	a	a	a	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Total	Exports	53,978	58,020	73,770	84,962	92,980	101,755	107,412	3.6	1.8
	Imports	1,722	3,030	3,137	3,416	3,343	3,457	3,457	5.4	0.1

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL, AND THROUGH

COMMODITY: Coal
ALTERNATIVE: Badenergy2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	6,872	8,450	10,503	15,101	18,166	19,667	20,318	6.2	2.3
Lower Upper Mississippi	10,683	11,754	15,436	25,974	34,420	41,633	44,411	7.1	4.2
Lower Mississippi	11,936	12,405	18,458	40,099	62,091	78,251	85,213	9.8	6.0
Baton Rouge to Gulf	10,410	11,004	17,234	38,483	58,596	73,959	80,467	10.6	5.8
Illinois River	9,625	10,701	12,691	15,206	17,381	18,712	19,307	3.6	1.9
Missouri River	1	2	2	3	3	3	3	4.6	1.9
Ohio River	100,229	104,737	131,969	166,663	201,948	229,283	243,203	4.0	2.9
Tennessee River	8,457	8,514	8,658	11,727	18,346	22,681	25,509	2.5	6.2
Arkansas River	515	649	1,124	3,791	5,800	7,469	8,041	16.6	6.0
Gulf Coast West	261	322	797	4,591	7,427	9,795	10,519	24.7	6.6
Gulf Coast East	8,446	7,974	13,028	20,861	32,453	39,309	42,532	7.2	5.6
Warrior River System	8,178	8,441	10,730	16,400	20,226	24,546	27,536	5.5	4.1
Great Lakes	22,615	29,288	30,097	28,588	32,514	35,885	37,225	1.8	2.1

* = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON-MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY: Coal
ALTERNATIVE: Hadenergy2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	2,213	2,488	2,878	3,968	4,721	5,169	5,340	4.6	2.3
Lower Upper Mississippi	1,351	1,541	1,976	3,218	4,234	5,082	5,402	6.9	4.1
Lower Mississippi	5,623	6,076	9,956	23,522	37,504	47,674	52,049	11.6	6.3
Baton Rouge to Gulf	1,459	1,595	2,418	4,627	7,043	8,795	9,645	9.3	5.8
Illinois River	1,260	1,483	1,785	2,144	2,502	2,730	2,830	4.2	2.2
Missouri River	a	a	a	a	a	a	a	4.6	1.9
Ohio River	20,152	21,547	28,802	40,078	50,367	58,549	62,364	5.4	3.5
Tennessee River	845	883	896	1,199	2,125	2,671	3,035	2.7	7.4
Arkansas River	189	238	413	1,394	2,132	2,746	2,956	16.6	6.0
Gulf Coast West	76	86	165	791	1,260	1,651	1,771	19.7	6.4
Gulf Coast East	449	410	741	1,244	2,363	2,944	3,254	8.1	7.7
Warrior River System	2,134	2,244	2,748	4,177	4,093	4,820	5,345	5.3	1.9
Great Lakes	8,206	11,422	11,805	11,089	12,952	14,552	15,188	2.3	2.4
Total	43,959	50,014	64,583	97,451	131,297	157,384	169,181	6.3	4.3

a = less than 500,000 ton-miles

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY Crude Petroleum
ALTERNATIVE Badenergy2003A

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Shipped	1	1	1	1	2	2	2	0.6	1.3
	Received	597	1,180	583	605	620	635	646	0.1	0.5
Lower Upper Mississippi	Shipped	14	14	14	15	15	16	17	0.5	1.2
	Received	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Shipped	36	36	36	37	39	40	41	0.2	0.6
	Received	2,750	2,709	2,704	2,824	2,886	2,949	3,000	0.2	0.5
Baton Rouge to Gulf	Shipped	11,066	11,407	11,031	11,720	12,229	12,870	13,389	0.4	1.0
	Received	12,168	25,344	23,243	30,131	32,896	38,914	43,538	7.2	2.9
Illinois River	Shipped	95	94	93	97	100	103	105	0.1	0.7
	Received	65	64	64	66	68	70	72	0.1	0.6
Missouri River	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Shipped	38	74	37	38	39	40	41	0.1	0.5
	Received	357	353	351	365	374	384	392	0.2	0.6
Tennessee River	Shipped	3	6	3	3	3	3	3	0.1	0.5
	Received	9	8	8	9	9	9	9	0.2	0.5
Arkansas River	Shipped	4	4	4	4	4	4	5	0.2	0.3
	Received	21	20	20	22	22	22	22	0.2	0.3
Gulf Coast West	Shipped	22,737	21,590	21,030	22,436	23,458	24,748	25,[illegible]98	0.1	1.1
	Received	20,527	38,765	35,883	45,578	49,426	57,735	64,118	6.3	2.7
Gulf Coast East	Shipped	1,028	883	759	812	854	910	955	1.8	1.3
	Received	347	202	58	62	66	70	73	-12.4	1.3
Warrior River System	Shipped	3,807	3,800	3,761	4,013	4,210	4,464	4,670	0.4	1.2
	Received	768	759	772	826	870	927	973	0.6	1.3
South Atlantic Coast	Shipped	666	658	666	703	729	763	791	0.4	0.9
	Received	0	0	0	0	0	0	0	0.0	0.0
Middle Atlantic Coast	Shipped	13,967	13,680	13,782	14,531	14,849	15,161	15,421	0.3	0.5
	Received	15,937	14,706	13,921	14,675	14,994	15,306	15,566	-0.6	0.5

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SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	0	0	0	0	0	0	0	0.0	0.0
Great Lakes and Seaway	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	0	0	0	0	0	0	0	0.0	0.0
Washington/Oregon Coast	Shipped	526	517	510	527	518	549	559	0.0	0.4
	Received	4,767	13,687	33,745	36,605	38,834	35,923	33,705	17.0	0.6
Columbia Snake Willamette River	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	253	1,278	1,202	1,071	883	642	460	11.7	-6.3
California Coast	Shipped	12,618	12,121	11,857	12,190	12,234	12,375	12,546	0.3	0.2
	Received	22,209	48,225	45,475	40,844	34,118	25,507	19,023	4.8	5.7
Alaska	Shipped	14,897	84,395	96,404	108,536	108,752	109,078	109,261	16.5	0.1
	Received	645	911	890	915	917	926	939	2.7	0.2
Hawaii and Pacific Territories	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	17	1,000	1,000	1,000	1,000	1,000	1,000	37.1	0.0
Domestic Caribbean	Shipped	54	54	54	54	54	54	54	0.0	0.0
	Received	122	122	122	122	122	122	122	0.0	0.0
Total	Shipped	81,557	149,334	160,041	175,719	178,109	181,141	183,656	6.1	0.3
	Received	81,557	149,334	160,041	175,719	178,109	181,141	183,656	6.1	0.3

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY Crude Petroleum
ALTERNATIVE Badenergy2003A

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77 90	90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0 0	0 0
	Imports	0	0	0	0	0	0	0	0 0	0 0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0 0	0 0
	Imports	0	0	0	0	0	0	0	0 0	0 0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0 0	0 0
	Imports	0	0	0	0	0	0	0	0 0	0 0
Baton Rouge to Gulf	Exports	0	0	0	0	0	0	0	0 0	0 0
	Imports	78,668	90,669	99,302	87,018	81,099	73,443	67,870	0 8	-1 9
Illinois River	Exports	0	0	0	0	0	0	0	0 0	0 0
	Imports	0	0	0	0	0	0	0	0 0	0 0
Missouri River	Exports	0	0	0	0	0	0	0	0 0	0 0
	Imports	0	0	0	0	0	0	0	0 0	0 0
Ohio River	Exports	0	0	0	0	0	0	0	0 0	0 0
	Imports	0	0	0	0	0	0	0	0 0	0 0
Tennessee River	Exports	0	0	0	0	0	0	0	0 0	0 0
	Imports	0	0	0	0	0	0	0	0 0	0 0
Arkansas River	Exports	0	0	0	0	0	0	0	0 0	0 0
	Imports	0	0	0	0	0	0	0	0 0	0 0
Gulf Coast West	Exports	53	49	42	36	31	26	25	-3 0	-2 8
	Imports	118,939	137,085	150,136	131,564	122,619	111,040	102,613	0 8	-1 9
Gulf Coast East	Exports	0	0	0	0	0	0	0	0 0	0 0
	Imports	9,270	10,384	11,443	9,977	9,235	8,252	7,523	0 6	-2 1
Warrior River System	Exports	0	0	0	0	0	0	0	0 0	0 0
	Imports	42	49	54	47	44	40	37	0 8	-1 9
South Atlantic Coast	Exports	a	a	a	a	a	a	a	3 0	-2 8
	Imports	1,300	611	768	603	473	272	108	5 7	-12 4
Middle Atlantic Coast	Exports	200	183	157	135	116	99	94	-3 0	2 8
	Imports	80,458	78,400	79,597	82,658	83,718	84,510	85,223	0 2	0 2

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SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	12,910	8,421	15,260	20,294	22,300	24,304	26,307	3.5	2.0
Great Lakes and Seaway	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	38	37	37	38	39	40	41	0.1	0.6
Washington/Oregon Coast	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	10,801	2,803	22,921	27,232	31,543	31,543	31,543	7.4	1.1
Columbia Snake Willamette River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	317	82	82	82	82	82	82	9.9	0.0
California Coast	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	48,790	12,141	12,141	12,141	12,141	12,141	12,141	-9.9	0.0
Alaska	Exports	1,[illegible]	0	0	0	0	0	0	-100.0	0.0
	Imports	303	0	0	0	0	0	0	100.0	0.0
Hawaii and Pacific Territories *	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	2,480	1,384	1,330	1,394	1,399	1,425	1,457	4.3	0.3
Domestic Caribbean	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	42,834	43,394	45,100	47,579	47,915	47,946	48,055	0.8	0.1
Total	Exports	1,964	232	199	171	147	126	118	-17.1	-2.8
	Imports	405,151	385,461	438,169	420,627	412,604	395,039	383,000	0.3	0.7

* = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL, AND THROUGH
COMMODITY Crude Petroleum
ALTERNATIVE Badenergy2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	598	1,181	585	606	621	636	648	0.1	0.5
Lower Upper Mississippi	752	1,333	735	763	783	804	820	0.1	0.6
Lower Mississippi	3,688	4,187	3,623	3,780	3,866	3,955	4,025	0.2	0.5
Baton Rouge to Gulf	18,415	32,052	29,423	36,643	39,628	45,907	50,739	5.4	2.5
Illinois River	150	148	147	153	157	162	166	0.1	0.6
Missouri River	0	0	0	0	0	0	0	0.0	0.0
Ohio River	406	442	399	415	426	437	445	0.2	0.5
Tennessee River	12	15	12	12	12	13	13	0.2	0.5
Arkansas River	21	20	20	22	22	22	22	0.2	0.3
Gulf Coast West	26,705	44,029	40,356	50,365	54,466	63,103	69,753	5.0	2.5
Gulf Coast East	4,857	4,723	4,580	4,890	5,133	5,447	5,701	0.1	1.2
Warrior River System	4,505	4,490	4,462	4,764	5,001	5,306	5,554	0.4	1.2
Great Lakes	0	0	0	0	0	0	0	0.0	0.0

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON-MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY Crude Petroleum
ALTERNATIVE Radenergy2003A

	YEARS							% GROWTH	
SEGMENT	1977	1980	1985	1990	1995	2000	2003	77-90	90-03
Upper Mississippi	365	722	357	370	380	389	396	0.1	0.5
Lower Upper Mississippi	164	290	160	166	170	175	178	0.1	0.6
Lower Mississippi	1,790	2,152	1,758	1,832	1,876	1,920	1,956	0.2	0.5
Baton Rouge to Gulf	1,461	3,292	2,938	3,840	4,186	4,960	5,552	7.7	2.9
Illinois River	45	45	44	46	47	49	50	0.1	0.7
Missouri River	0	0	0	0	0	0	0	0.0	0.0
Ohio River	151	158	148	154	158	162	165	0.1	0.6
Tennessee River	5	6	4	5	5	5	5	0.2	0.5
Arkansas River	3	3	3	3	3	3	3	0.2	0.3
Gulf Coast West	2,749	3,201	3,143	3,548	3,752	4,103	4,378	2.0	1.6
Gulf Coast East	532	503	470	501	526	557	583	0.5	1.2
Warrior River System	231	231	229	245	257	273	285	0.4	1.2
Great Lakes	0	0	0	0	0	0	0	0.0	0.0
Total	7,495	10,601	9,254	10,710	11,360	12,596	13,552	2.8	1.8

a = less than 500,000 ton-miles

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY Nonmetallic Minerals
ALTERNATIVE Badenergy2003A

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77 90	90 03
Upper Mississippi	Shipped	1,970	1,918	1,758	1,482	1,351	1,280	1,142	2.2	2.0
	Received	2,997	2,853	2,568	2,175	1,395	1,981	1,883	2.4	1.1
Lower Upper Mississippi	Shipped	1,136	1,104	1,012	859	785	743	668	2.1	1.9
	Received	1,383	1,358	1,287	1,154	1,109	1,103	1,050	1.4	-0.7
Lower Mississippi	Shipped	661	644	591	497	454	430	384	2.2	2.0
	Received	1,876	1,834	1,721	1,520	1,440	1,414	1,326	1.8	-1.0
Baton Rouge to Gulf	Shipped	4,721	4,981	5,481	5,495	5,605	5,872	6,056	1.2	0.8
	Received	10,398	10,667	15,259	16,740	18,062	20,477	21,754	3.7	2.0
Illinois River	Shipped	3,571	3,492	3,234	2,761	2,547	2,437	2,205	-2.0	-1.7
	Received	6,450	6,193	5,676	5,018	4,645	4,486	4,273	-1.9	-1.2
Missouri River	Shipped	3,049	2,970	2,724	2,292	2,090	1,982	1,766	-2.2	2.0
	Received	3,166	3,090	2,854	2,436	2,250	2,159	1,955	2.0	-1.7
Ohio River	Shipped	19,451	18,923	17,355	14,669	13,392	12,686	11,349	-2.1	-2.0
	Received	19,352	18,889	17,549	15,223	14,200	13,728	12,634	-1.8	-1.4
Tennessee River	Shipped	2,551	2,485	2,279	1,918	1,750	1,659	1,478	2.2	-2.0
	Received	2,927	2,871	2,715	2,426	2,324	2,306	2,187	1.4	-0.8
Arkansas River	Shipped	2,989	2,911	2,670	2,246	2,049	1,943	1,731	-2.2	-2.0
	Received	3,017	2,939	2,697	2,273	2,076	1,970	1,758	-2.2	-2.0
Gulf Coast West	Shipped	12,268	12,654	13,481	13,757	14,344	15,148	15,563	0.9	1.0
	Received	6,705	6,747	6,734	6,478	6,489	6,622	6,571	-0.3	0.1
Gulf Coast East	Shipped	9,985	10,093	14,430	15,835	17,007	19,295	20,529	3.6	2.0
	Received	5,202	5,688	6,642	6,780	6,954	7,173	7,283	2.1	0.6
Warrior River System	Shipped	2,465	2,382	2,188	1,898	1,744	1,647	1,509	-2.0	1.7
	Received	1,792	1,757	1,651	1,457	1,383	1,361	1,277	-1.6	1.0
South Atlantic Coast	Shipped	758	788	812	796	768	744	729	0.4	-0.7
	Received	1,132	1,173	1,216	1,277	1,323	1,374	1,406	0.9	0.7
Middle Atlantic Coast	Shipped	9,018	10,133	8,758	7,971	6,092	4,450	3,306	0.9	6.5
	Received	10,129	11,340	9,887	9,071	7,078	5,142	4,130	0.8	5.9

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4/16/80

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77 90	90 03
North Atlantic Coast	Shipped	950	1,069	921	837	635	459	336	1.0	-6.8
	Received	342	380	338	316	258	208	172	0.6	4.5
Great Lakes and Seaway	Shipped	31,236	36,617	43,021	49,941	55,147	60,758	64,021	3.7	1.9
	Received	29,710	35,176	41,705	48,735	54,040	59,738	63,047	3.9	2.0
Washington/Oregon Coast	Shipped	2,551	2,591	2,360	2,069	1,831	1,665	1,470	-1.6	-2.6
	Received	2,719	2,785	2,521	2,211	1,928	1,722	1,500	1.6	-2.9
Columbia-Snake Willamette River	Shipped	4,842	4,759	4,349	3,681	3,322	3,110	2,753	-2.1	-2.2
	Received	4,597	4,484	4,112	3,465	3,159	2,992	2,666	-2.2	-2.0
California Coast	Shipped	714	786	696	642	520	413	339	-0.8	-4.8
	Received	853	930	852	759	599	454	357	-0.9	-5.6
Alaska	Shipped	24	26	23	21	16	12	9	-0.9	-5.9
	Received	100	108	99	94	83	73	66	-0.5	-2.7
Hawaii and Pacific Territories	Shipped	49	55	48	43	33	25	18	0.9	6.4
	Received	68	75	66	61	49	39	32	0.8	-4.9
Domestic Caribbean	Shipped	2	*	*	*	*	*	*	3.3	-2.7
	Received	45	46	44	42	39	37	35	-0.5	-1.3
Total	Shipped	114,959	121,384	128,192	129,710	131,483	136,760	137,381	0.9	0.4
	Received	114,959	121,384	128,192	129,710	131,483	136,760	137,361	0.9	0.4

* = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY: Nonmetallic Minerals
ALTERNATIVE: Badenergy2003A

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	562	580	614	654	700	752	787	1.2	1.4
	Imports	1,230	1,286	1,582	1,779	1,977	2,247	2,430	2.9	2.4
Illinois River	Exports	282	306	352	405	466	536	584	2.8	2.8
	Imports	164	171	211	250	292	343	378	3.3	3.2
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	965	976	998	1,023	1,051	1,084	1,106	0.5	0.6
	Imports	1,667	1,751	2,203	2,565	2,945	3,428	3,763	3.4	3.0
Gulf Coast East	Exports	12,499	12,987	13,804	10,784	7,769	4,760	2,958	-1.1	-9.5
	Imports	2,551	2,786	3,533	3,872	4,229	4,681	4,995	3.3	2.0
Warrior River System	Exports	4	4	5	5	6	7	8	2.8	2.8
	Imports	1	1	2	2	2	3	3	3.0	3.1
South Atlantic Coast	Exports	2,730	2,887	3,168	2,959	2,779	2,634	2,566	0.6	-1.1
	Imports	2,273	2,276	2,660	2,736	2,791	2,954	3,066	1.4	0.9
Middle Atlantic Coast	Exports	109	119	136	156	179	206	223	2.8	2.8
	Imports	5,258	5,308	6,315	6,703	7,069	7,701	8,142	1.9	1.5

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SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic	Exports	3	3	3	4	4	5	5	2.7	2.7
Coast	Imports	1,044	1,074	1,307	1,479	1,662	1,899	2,065	2.7	2.6
Great Lakes and	Exports	3,500	3,807	4,379	5,037	5,794	6,665	7,249	2.8	2.8
Seaway	Imports	2,208	2,262	2,501	2,729	2,979	3,278	3,489	1.6	1.9
Washington/Oregon	Exports	1,107	1,204	1,384	1,591	1,832	2,107	2,292	2.8	2.8
Coast	Imports	1,902	1,967	2,258	2,454	2,650	2,916	3,098	2.0	1.8
Columbia Snake	Exports	111	121	139	160	184	211	230	2.8	2.8
Willamette River	Imports	1,021	1,050	1,182	1,284	1,388	1,524	1,617	1.8	1.8
California Coast	Exports	858	933	1,073	1,234	1,419	1,632	1,775	2.8	2.8
	Imports	1,323	1,414	1,864	2,080	2,273	2,581	2,786	3.5	2.3
Alaska	Exports	166	181	208	239	275	316	344	2.8	2.8
	Imports	24	25	27	29	32	34	36	1.5	1.6
Hawaii and Pacific	Exports	19	21	24	28	32	37	40	2.8	2.8
Territories	Imports	45	46	50	52	53	55	57	1.0	0.7
Domestic Caribbean	Exports	118	120	122	124	127	130	132	0.4	0.5
	Imports	273	286	356	410	466	538	588	3.2	2.8
Total	Exports	23,031	24,247	26,410	24,404	22,617	21,083	20,299	0.4	1.4
	Imports	20,985	21,705	26,051	28,425	30,807	34,102	36,514	2.4	1.9

* = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL, AND THROUGH
COMMODITY Nonmetallic Minerals
ALTERNATIVE Badene[illegible],2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003 a	% GROWTH 77-90	90-03
Upper Mississippi	2,997	2,853	2,569	2,175	1,995	1,981	1,883	-2.4	-1.1
Lower Upper Mississippi	4,276	4,082	3,779	3,463	3,329	3,445	3,512	-1.6	0.1
Lower Mississippi	8,263	8,058	7,774	7,426	7,414	7,748	7,900	-0.8	0.5
Baton Rouge to Gulf	17,576	17,923	22,885	24,488	26,072	29,026	30,699	2.6	1.8
Illinois River	6,635	6,388	5,884	5,229	4,864	4,716	4,508	-1.8	-1.1
Missouri River	3,218	3,140	2,900	2,475	2,285	2,192	1,985	-2.0	-1.7
Ohio River	22,146	21,631	20,148	17,558	16,446	15,964	14,765	-1.8	-1.3
Tennessee River	3,329	3,262	3,074	2,728	2,600	2,568	2,420	-1.5	-0.9
Arkansas River	3,018	2,940	2,698	2,274	2,077	1,970	1,758	-2.2	-2.0
Gulf Coast West	13,681	14,066	14,896	15,165	15,765	16,593	17,015	0.8	0.9
Gulf Coast East	14,058	14,604	19,874	21,473	22,841	25,358	26,731	3.3	1.7
Warrior River System	2,661	2,580	2,398	2,122	1,986	1,912	1,789	-1.7	-1.3
Great Lakes	31,287	36,669	43,072	49,992	55,199	60,814	64,078	3.7	1.9

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY Nonmetallic Minerals
ALTERNATIVE Badenergy2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	400	368	321	274	254	271	280	-2.9	0.2
Lower Upper Mississippi	693	656	605	564	546	575	602	-1.6	0.5
Lower Mississippi	4,698	4,578	4,445	4,319	4,357	4,606	4,763	-0.6	0.8
Baton Rouge to Gulf	2,141	2,151	2,821	3,028	3,223	3,625	3,853	2.7	1.9
Illinois River	605	579	535	487	458	448	440	-1.6	-0.8
Missouri River	394	386	362	319	302	296	277	-1.6	-1.1
Ohio River	2,860	2,826	2,746	2,585	2,566	2,620	2,583	-0.8	0.0
Tennessee River	294	290	279	258	254	258	252	-1.0	-0.2
Arkansas River	45	44	41	35	32	31	28	-2.0	-1.7
Gulf Coast West	1,319	1,366	1,470	1,497	1,552	1,626	1,664	1.0	0.8
Gulf Coast East	582	616	698	713	730	758	776	1.6	0.6
Warrior River System	221	214	198	172	160	153	141	-1.9	-1.5
Great Lakes	9,607	11,148	12,974	14,953	16,445	18,060	19,004	3.5	1.9
Total	23,859	25,222	27,495	29,204	30,877	33,328	34,664	1.6	1.3

a = less than 500,000 ton-miles

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY Food and Kindred Products
ALTERNATIVE Badenergy2003A

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Shipped	1,486	1,863	2,049	2,388	2,405	2,268	1,832	3.7	-2.0
	Received	169	173	177	181	185	190	193	0.5	0.5
Lower Upper Mississippi	Shipped	1,818	2,323	2,545	3,024	3,030	2,810	2,160	4.0	-2.6
	Received	156	160	166	171	178	186	191	0.7	0.9
Lower Mississippi	Shipped	1,304	1,670	1,846	2,179	2,191	2,051	1,616	4.0	-2.3
	Received	128	130	136	141	148	156	162	0.8	1.1
Baton Rouge to Gulf	Shipped	1,310	1,372	1,443	1,523	1,598	1,677	1,710	1.2	0.9
	Received	7,017	8,891	9,792	11,522	11,606	10,909	8,686	3.9	-2.2
Illinois River	Shipped	556	687	747	870	874	821	658	3.5	-2.1
	Received	471	486	507	527	552	581	600	0.9	1.0
Missouri River	Shipped	559	687	752	866	873	829	685	3.4	-1.8
	Received	180	185	189	193	198	203	207	0.5	0.5
Ohio River	Shipped	338	425	462	545	546	507	392	3.[illegible]	2.5
	Received	234	239	247	255	265	276	285	0.6	0.9
Tennessee River	Shipped	540	686	763	888	897	850	693	3.9	-1.9
	Received	170	170	170	170	170	171	171	0.0	0.0
Arkansas River	Shipped	140	180	197	236	237	218	165	4.1	-2.7
	Received	38	38	39	40	41	42	42	0.4	0.4
Gulf Coast West	Shipped	760	810	843	890	908	914	883	1.2	-0.1
	Received	486	501	517	532	549	568	580	0.7	0.7
Gulf Coast East	Shipped	450	485	519	557	585	615	624	1.6	0.9
	Received	122	130	139	148	158	170	177	1.5	1.4
Warrior River System	Shipped	88	95	99	106	108	107	99	1.5	-0.5
	Received	37	37	37	38	38	38	38	0.1	0.1
South Atlantic Coast	Shipped	328	358	396	431	468	513	544	2.1	1.8
	Received	290	319	356	391	426	470	499	2.3	1.9
Middle Atlantic Coast	Shipped	1,289	1,400	1,562	1,703	1,848	2,016	2,124	2.2	1.7
	Received	984	1,065	1,190	1,294	1,405	1,531	1,612	2.1	1.7

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SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77 90	90 03
North Atlantic Coast	Shipped	62	66	73	78	84	92	97	1.9	1.6
	Received	32	34	36	38	41	44	45	1.5	1.3
Great Lakes and Seaway	Shipped	322	322	322	322	322	322	322	0.0	0.0
	Received	322	322	322	322	322	322	322	0.0	0.0
Washington/Oregon Coast	Shipped	361	395	439	480	524	578	614	2.2	1.9
	Received	228	249	275	299	324	355	376	2.1	1.8
Columbia-Snake Willamette River	Shipped	60	63	69	75	83	92	98	1.8	2.1
	Received	85	91	98	104	111	120	125	1.6	1.4
California Coast	Shipped	1,135	1,253	1,414	1,572	1,741	1,949	2,091	2.5	2.2
	Received	1,826	2,013	2,254	2,477	2,709	2,993	3,185	2.4	2.0
Alaska	Shipped	167	184	206	227	248	274	292	2.4	2.0
	Received	309	340	380	417	456	503	535	2.3	1.9
Hawaii and Pacific Territories	Shipped	2,069	2,282	2,560	2,821	3,094	3,428	3,655	2.4	2.0
	Received	1,055	1,167	1,326	1,486	1,663	1,879	2,026	2.7	2.4
Domestic Caribbean	Shipped	494	529	571	610	650	700	734	1.6	1.4
	Received	1,295	1,395	1,524	1,645	1,771	1,926	2,030	1.9	1.6
Total	Shipped	15,634	18,132	19,876	22,393	23,314	23,631	22,087	2.8	0.1
	Received	15,634	18,132	19,876	22,393	23,314	23,631	22,087	2.8	-0.1

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY Food and Kindred Products
ALTERNATIVE Badenergy2003A

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	8,246	10,092	11,020	12,726	12,813	12,140	9,969	3.4	1.9
	Imports	2,649	2,763	3,374	4,014	4,879	5,936	6,695	3.2	4.0
Illinois River	Exports	230	275	299	342	345	331	280	3.1	1.5
	Imports	23	24	29	34	41	50	56	3.1	3.9
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	1,094	1,246	1,369	1,508	1,543	1,537	1,426	2.5	0.4
	Imports	1,000	1,031	1,248	1,476	1,786	2,166	2,441	3.0	3.9
Gulf Coast East	Exports	712	851	923	1,062	1,071	1,021	851	3.1	1.7
	Imports	396	408	492	581	702	851	958	3.0	3.9
Warrior River System	Exports	113	134	146	168	169	161	135	3.1	1.7
	Imports	42	43	48	54	62	72	79	2.0	2.9
South Atlantic Coast	Exports	532	580	635	686	707	720	698	2.0	0.1
	Imports	554	570	690	815	985	1,194	1,345	3.0	3.9
Middle Atlantic Coast	Exports	1,394	1,543	1,683	1,842	1,890	1,900	1,794	2.2	0.2
	Imports	5,951	6,138	7,404	8,716	10,500	12,674	14,239	3.0	3.8

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SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic	Exports	53	54	59	62	65	68	69	1.3	0.8
Coast	Imports	720	742	898	1,063	1,287	1,562	1,760	3.0	4.0
Great Lakes and	Exports	470	511	576	642	655	646	585	2.4	-0.7
Seaway	Imports	69	71	87	102	124	151	170	3.0	4.0
Washington/Oregon	Exports	621	710	770	865	880	861	766	2.6	0.9
Coast	Imports	130	134	163	192	233	282	318	3.0	4.0
Columbia Snake	Exports	150	157	171	182	189	195	195	1.5	0.6
Willamette River	Imports	131	140	173	205	248	299	334	3.5	3.8
California Coast	Exports	1,604	1,732	1,891	2,035	2,101	2,149	2,106	1.8	0.3
	Imports	1,190	1,252	1,527	1,809	2,187	2,644	2,970	3.3	3.9
Alaska	Exports	11	12	13	13	14	15	15	1.2	1.0
	Imports	26	27	31	36	43	51	56	2.5	3.5
Hawaii and Pacific	Exports	9	10	11	12	12	12	12	1.9	0.0
Territories	Imports	33	34	39	45	53	63	70	2.5	3.4
Domestic Caribbean	Exports	103	117	127	142	145	143	128	2.5	-0.8
	Imports	390	400	470	543	643	765	854	2.6	3.5
Total	Exports	15,344	18,044	19,691	22,287	22,599	21,900	19,028	2.9	1.2
	Imports	13,305	13,776	16,672	19,685	23,774	28,758	32,345	3.1	3.9

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL, AND THROUGH
COMMODITY Food and Kindred Products
ALTERNATIVE Badenergy2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
Upper Mississippi	1,651	2,032	2,222	2,565	2,587	2,455	2,021	3.4	-1.8
Lower Upper Mississippi	5,321	6,488	7,054	8,143	8,216	7,808	6,443	3.3	-1.8
Lower Mississippi	7,691	9,504	10,392	12,075	12,186	11,554	9,443	3.5	-1.9
Baton Rouge to Gulf	8,453	10,374	11,342	13,137	13,298	12,693	10,531	3.4	-1.7
Illinois River	1,018	1,163	1,243	1,386	1,415	1,390	1,246	2.4	-0.8
Missouri River	739	872	941	1,059	1,071	1,032	891	2.8	-1.3
Ohio River	1,243	1,480	1,603	1,820	1,839	1,765	1,502	3.0	-1.5
Tennessee River	709	855	932	1,058	1,067	1,020	863	3.1	-1.6
Arkansas River	177	219	237	276	277	260	207	3.5	2.2
Gulf Coast West	866	922	962	1,015	1,040	1,054	1,029	1.2	0.1
Gulf Coast East	579	624	667	715	750	783	788	1.6	0.7
Warrior River System	125	132	137	144	146	145	138	1.1	-0.3
Great Lakes	322	322	322	322	322	322	322	0.0	0.0

a = less than 500 tons

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WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY: Food and Kindred Products
ALTERNATIVE: Radenergy2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	566	696	762	879	886	841	693	3.4	-1.8
Lower Upper Mississippi	1,101	1,342	1,460	1,685	1,700	1,616	1,334	3.3	-1.8
Lower Mississippi	4,905	6,056	6,620	7,690	7,762	7,362	6,023	3.5	-1.9
Baton Rouge to Gulf	964	1,175	1,282	1,479	1,498	1,433	1,197	3.3	1.6
Illinois River	253	289	309	344	351	345	309	2.4	-0.8
Missouri River	451	532	574	646	653	630	544	2.8	-1.3
Ohio River	247	283	302	338	343	335	295	2.5	-1.0
Tennessee River	256	308	336	382	385	368	311	3.1	-1.6
Arkansas River	62	76	83	97	97	91	72	3.5	-2.2
Gulf Coast West	88	98	104	114	115	114	103	2.0	-0.7
Gulf Coast East	16	17	18	19	19	19	18	1.6	-0.4
Warrior River System	4	4	4	4	4	4	4	1.1	0.3
Great Lakes	88	88	88	88	88	88	88	0.0	0.0
Total	8,999	10,965	11,940	13,764	13,903	13,245	10,992	3.3	1.7

a = less than 500,000 ton-miles

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY Lumber and Wood Products
ALTERNATIVE Badenergy2003A

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Shipped	12	17	19	19	20	20	21	3.4	0.5
	Received	7	12	14	14	15	15	15	5.1	0.6
Lower Upper Mississippi	Shipped	18	19	20	21	21	21	22	1.0	0.4
	Received	23	23	26	26	27	27	28	0.9	0.5
Lower Mississippi	Shipped	441	454	506	512	528	544	552	1.1	0.6
	Received	428	450	488	501	514	528	536	1.2	0.5
Baton Rouge to Gulf	Shipped	140	142	164	161	167	173	174	1.1	0.6
	Received	136	136	149	152	156	160	162	0.9	0.5
Illinois River	Shipped	20	21	22	22	22	23	23	0.7	0.3
	Received	78	73	101	90	96	102	102	1.1	1.0
Missouri River	Shipped	3	3	3	3	3	3	3	1.2	0.5
	Received	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Shipped	35	36	39	40	42	43	43	1.2	0.5
	Received	8	8	8	8	8	8	8	0.4	0.9
Tennessee River	Shipped	361	374	410	419	431	444	450	1.2	0.6
	Received	361	374	410	419	431	444	450	1.2	0.6
Arkansas River	Shipped	12	12	14	14	14	15	15	1.2	0.6
	Received	5	5	5	5	5	5	5	1.0	0.5
Gulf Coast West	Shipped	65	64	66	66	66	66	67	0.1	0.1
	Received	37	35	32	31	30	29	28	-1.3	-0.8
Gulf Coast East	Shipped	13	12	14	14	15	15	16	0.7	0.7
	Received	101	106	114	117	121	124	126	1.2	0.5
Warrior River System	Shipped	431	447	491	502	517	532	540	1.2	0.6
	Received	284	298	322	330	338	347	352	1.1	0.5
South Atlantic Coast	Shipped	726	680	647	591	551	516	494	-1.6	-1.4
	Received	393	167	328	294	264	237	222	2.2	2.1
Middle Atlantic Coast	Shipped	343	305	383	380	412	444	453	0.8	1.4
	Received	679	611	684	658	681	704	706	0.2	0.5

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SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Shipped	a	a	a	a	a	a	a	0.8	1.3
	Received	a	a	a	a	a	1	1	1.8	1.9
Great Lakes and Seaway	Shipped	177	161	160	160	161	161	161	-0.8	0.0
	Received	177	161	160	160	161	161	161	-0.8	0.0
Washington/Oregon Coast	Shipped	8,948	11,183	10,521	11,112	11,143	11,408	11,483	1.7	0.3
	Received	7,891	10,429	9,577	10,150	10,147	10,397	10,469	1.9	0.2
Columbia-Snake Willamette River	Shipped	9,790	12,636	11,706	12,418	12,447	12,770	12,873	1.8	0.3
	Received	9,562	12,456	11,494	12,204	12,228	12,550	12,653	1.9	0.3
California Coast	Shipped	30	25	30	30	31	32	32	0.1	0.3
	Received	810	633	795	812	838	847	847	0.0	0.3
Alaska	Shipped	1,556	2,136	2,058	2,187	2,217	2,286	2,311	2.7	0.4
	Received	1,731	2,276	2,239	2,370	2,408	2,483	2,510	2.4	0.4
Hawaii and Pacific Territories	Shipped	76	84	100	106	113	120	125	2.6	1.2
	Received	280	253	303	311	323	332	337	0.8	0.6
Domestic Caribbean	Shipped	6	5	3	3	2	2	2	-6.1	2.6
	Received	121	116	134	134	139	144	145	0.8	0.7
Total	Shipped	23,204	28,815	27,377	28,780	28,922	29,638	29,858	1.7	0.3
	Received	23,204	28,815	27,377	28,780	28,922	29,638	29,858	1.7	0.3

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY Lumber and Wood Products
ALTERNATIVE Barlenergy20U3A

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	108	117	146	148	157	167	168	2.5	1.0
	Imports	175	149	187	171	171	185	182	-0.1	0.5
Illinois River	Exports	5	5	6	5	5	5	5	-1.0	0.0
	Imports	1	1	1	1	1	1	1	-0.2	0.1
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	274	323	510	597	631	635	636	6.2	0.5
	Imports	208	181	230	213	213	232	228	0.2	0.5
Gulf Coast East	Exports	35	63	85	98	107	112	113	8.3	1.1
	Imports	77	68	94	93	92	107	103	1.5	0.8
Warrior River System	Exports	111	160	206	235	259	275	277	5.9	1.3
	Imports	93	82	108	110	109	125	120	1.3	0.7
South Atlantic Coast	Exports	441	556	788	891	951	974	980	5.6	0.7
	Imports	600	522	634	582	572	613	601	-0.2	0.2
Middle Atlantic Coast	Exports	257	325	448	432	447	467	476	4.1	0.7
	Imports	1,414	1,180	1,527	1,456	1,390	1,572	1,512	0.2	0.3

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SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Exports	11	13	19	16	16	16	17	2.7	0.5
	Imports	261	213	284	275	260	300	286	0.4	0.3
Great Lakes and Seaway	Exports	50	60	322	398	405	412	406	17.3	0.1
	Imports	9	8	8	8	7	7	7	1.6	0.6
Washington/Oregon Coast	Exports	13,485	11,826	11,934	9,530	8,731	9,410	8,273	2.6	1.1
	Imports	2,689	2,529	3,093	3,193	3,227	3,609	3,516	1.3	0.7
Columbia/Snake Willamette River	Exports	5,470	4,816	4,853	3,881	3,556	3,427	3,353	2.6	1.1
	Imports	160	140	177	162	164	178	175	0.1	0.6
California Coast	Exports	1,579	1,446	1,504	1,322	1,196	1,120	1,076	1.4	1.6
	Imports	479	419	591	579	589	682	660	1.5	1.0
Alaska	Exports	989	1,001	938	839	779	744	[illegible]	1.3	1.0
	Imports	233	230	240	240	241	247	246	0.2	0.2
Hawaii and Pacific Territories	Exports	40	38	44	43	40	37	36	0.5	1.3
	Imports	8	7	10	10	10	11	11	1.2	0.8
Domestic Caribbean	Exports	5	6	7	8	7	7	7	3.9	0.2
	Imports	158	134	188	188	186	219	209	1.3	0.8
Total	Exports	22,859	20,754	21,812	18,442	17,285	16,908	16,515	-1.6	0.8
	Imports	6,565	5,864	7,351	7,283	7,232	8,088	7,859	0.8	0.6

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC INBOUND, OUTBOUND, LOCAL, AND THROUGH

COMMODITY Lumber and Wood Products
ALTERNATIVE Badenergy2003A

SEGMENT	1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
Upper Mississippi	15	20	22	22	23	24	24	3.0	0.6
Lower Upper Mississippi	133	128	161	151	159	166	167	1.0	0.8
Lower Mississippi	555	569	641	643	665	686	695	1.1	0.6
Baton Rouge to Gulf	190	188	217	213	221	228	230	0.9	0.6
Illinois River	98	94	123	112	118	125	125	1.1	0.8
Missouri River	3	3	3	3	3	3	3	1.2	0.5
Ohio River	35	37	40	41	42	43	44	1.2	0.5
Tennessee River	361	374	410	419	431	444	450	1.2	0.6
Arkansas River	12	13	14	14	15	15	15	1.1	0.6
Gulf Coast West	72	71	73	72	72	73	73	0.0	0.0
Gulf Coast East	124	127	140	142	146	150	152	1.0	0.5
Warrior River System	444	457	502	512	527	542	549	1.1	0.5
Great Lakes	177	161	160	160	161	161	161	-0.8	0.0

a = less than 500 tons

4/16/80

WATERBURNE DEMAND PROJECTIONS
MILLIONS OF TON-MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY Lumber and Wood Products
ALTERNATIVE Badenergy2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	3	3	3	3	3	4	4	0.8	0.6
Lower Upper Mississippi	25	24	31	29	30	32	32	1.0	0.8
Lower Mississippi	137	137	162	158	164	171	172	1.1	0.7
Baton Rouge to Gulf	25	24	29	28	29	30	30	0.8	0.7
Illinois River	26	24	32	29	31	33	33	1.1	0.8
Missouri River	a	a	1	1	1	1	1	1.2	0.5
Ohio River	13	14	15	15	16	16	16	1.2	0.5
Tennessee River	42	43	48	49	50	51	52	1.2	0.6
Arkansas River	1	1	1	1	1	1	1	1.2	0.6
Gulf Coast West	2	2	2	2	2	2	2	-1.0	-0.5
Gulf Coast East	9	9	10	10	10	10	11	1.0	0.5
Warrior River System	45	47	51	52	54	55	56	1.2	0.5
Great Lakes	45	40	40	40	40	40	40	-0.9	0.0
Total	373	369	424	416	431	445	449	0.8	0.6

a = less than 500,000 ton-miles

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY Pulp, Paper and Allied Products
ALTERNATIVE Badenergy2003A

SEGMENT	IN/OUT	1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
Upper Mississippi	Shipped	1	1	1	1	1	2	2	2.4	2.1
	Received	14	14	15	16	16	16	16	0.8	0.4
Lower Upper Mississippi	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	6	6	6	6	6	7	7	0.8	0.4
Lower Mississippi	Shipped	195	202	216	224	232	241	247	1.0	0.8
	Received	3	3	3	4	4	4	4	0.8	0.4
Baton Rouge to Gulf	Shipped	102	109	121	132	143	155	163	2.0	1.7
	Received	466	487	523	548	575	604	622	1.3	1.0
Illinois River	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	29	31	36	40	44	49	52	2.4	2.1
Missouri River	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	6	6	7	7	7	7	7	0.8	0.4
Ohio River	Shipped	3	3	3	3	3	3	3	0.8	0.4
	Received	13	14	14	15	15	15	16	0.8	0.4
Tennessee River	Shipped	163	171	185	195	205	217	225	1.4	1.1
	Received	131	138	150	159	169	180	187	1.5	1.3
Arkansas River	Shipped	118	122	128	131	133	136	138	0.8	0.4
	Received	4	4	4	5	5	6	6	2.4	2.1
Gulf Coast West	Shipped	47	49	52	54	56	59	60	1.1	0.9
	Received	39	40	42	42	43	44	45	0.7	0.4
Gulf Coast East	Shipped	138	145	157	166	176	186	193	1.4	1.2
	Received	28	29	31	32	34	35	36	1.1	0.8
Warrior River System	Shipped	17	18	20	21	23	25	26	1.8	1.6
	Received	9	9	10	11	11	12	12	1.7	1.1
South Atlantic Coast	Shipped	379	406	457	488	521	556	579	2.0	1.3
	Received	53	57	63	69	75	82	86	1.9	1.7
Middle Atlantic Coast	Shipped	108	108	114	119	125	130	134	0.8	0.9
	Received	254	272	304	325	348	372	387	1.9	1.4

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4/16/80

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Shipped	2	2	3	3	3	3	3	1.8	0.8
	Received	1	1	1	1	1	1	1	1.8	1.0
Great Lakes and Seaway	Shipped	434	437	441	444	446	448	450	0.2	0.1
	Received	434	437	441	444	446	448	450	0.2	0.1
Washington/Oregon Coast	Shipped	381	411	477	513	545	578	599	2.3	1.2
	Received	456	491	575	627	670	713	741	2.5	1.3
Columbia-Snake Willamette River	Shipped	1,736	1,879	2,172	2,313	2,446	2,583	2,670	2.2	1.1
	Received	1,708	1,850	2,141	2,281	2,413	2,549	2,635	2.3	1.1
California Coast	Shipped	66	69	74	76	78	80	81	1.1	0.5
	Received	13	7	a	a	a	a	a	-29.7	2.5
Alaska	Shipped	115	123	146	163	176	188	197	2.7	1.5
	Received	20	22	26	27	28	30	31	2.1	1.0
Hawaii and Pacific Territories	Shipped	40	48	63	68	74	80	84	4.1	1.6
	Received	149	162	185	194	203	212	218	2.0	0.9
Domestic Caribbean	Shipped	9	9	10	11	11	11	12	1.4	0.7
	Received	217	233	262	273	285	298	306	1.8	0.9
Total	Shipped	4,055	4,312	4,841	5,124	5,398	5,683	5,866	1.8	1.0
	Received	4,055	4,312	4,841	5,124	5,398	5,683	5,866	1.8	1.0

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY Pulp, Paper and Allied Products
ALTERNATIVE Radenergy2003A

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	829	918	1,117	1,227	1,352	1,458	1,542	3.1	1.8
	Imports	92	79	56	44	37	31	30	-5.5	-3.0
Illinois River	Exports	2	2	3	3	4	4	5	3.1	2.2
	Imports	72	74	77	78	80	82	83	0.6	0.5
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	261	287	346	388	430	471	502	3.1	2.0
	Imports	26	22	16	12	11	9	8	5.5	3.0
Gulf Coast East	Exports	260	287	347	387	428	467	496	3.1	1.9
	Imports	34	29	21	16	14	11	11	-5.5	-3.0
Warrior River System	Exports	142	158	195	210	229	244	256	3.0	1.5
	Imports	104	96	85	78	74	71	69	-2.2	-0.9
South Atlantic Coast	Exports	1,458	1,614	2,044	2,243	2,464	2,652	2,738	3.4	1.5
	Imports	359	335	302	275	254	237	228	-2.0	-1.4
Middle Atlantic Coast	Exports	389	428	527	595	659	725	768	3.3	2.0
	Imports	642	590	519	461	415	379	362	-2.5	1.9

4/16/80

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Exports	64	71	89	98	109	118	123	3.3	1.7
	Imports	87	85	83	81	80	78	77	-0.5	-0.4
Great Lakes and Seaway	Exports	3	4	4	5	5	6	6	2.5	2.0
	Imports	345	346	352	348	345	342	343	0.1	-0.1
Washington/Oregon Coast	Exports	682	686	656	628	648	640	643	0.6	0.2
	Imports	242	237	230	220	210	202	198	-0.7	-0.8
Columbia Snake Willamette River	Exports	269	266	253	247	254	254	257	0.7	0.3
	Imports	1	1	1	1	1	1	*	-1.6	-1.4
California Coast	Exports	380	387	372	351	364	355	355	-0.6	0.1
	Imports	606	580	542	502	466	439	423	-1.4	-1.3
Alaska	Exports	252	259	250	233	242	234	233	-0.6	0.0
	Imports	13	12	12	11	10	9	9	-1.5	-1.4
Hawaii and Pacific Territories	Exports	*	*	*	*	*	*	*	2.6	2.0
	Imports	24	22	20	18	16	15	14	-2.1	-1.7
Domestic Caribbean	Exports	21	23	26	30	33	36	39	2.6	2.0
	Imports	37	34	31	28	25	23	22	-2.1	-1.7
Total	Exports	5,015	5,391	6,231	6,645	7,221	7,666	7,962	2.2	1.4
	Imports	2,683	2,543	2,346	2,174	2,037	1,930	1,878	-1.6	1.1

* = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL, AND THROUGH
COMMODITY: Pulp, Paper and Allied Products
ALTERNATIVE: Badenergy2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	15	15	16	17	17	18	18	0.9	0.6
Lower Upper Mississippi	56	59	65	69	74	80	84	1.7	1.4
Lower Mississippi	369	383	408	424	441	458	470	1.1	0.8
Baton Rouge to Gulf	551	576	621	652	685	721	744	1.3	1.0
Illinois River	29	31	36	40	44	49	52	2.4	2.1
Missouri River	6	6	7	7	7	7	7	0.8	0.4
Ohio River	44	46	48	49	50	51	52	0.8	0.4
Tennessee River	163	171	185	195	205	217	225	1.4	1.1
Arkansas River	122	126	132	136	139	142	144	0.8	0.5
Gulf Coast West	68	70	74	77	80	83	85	1.0	0.7
Gulf Coast East	182	190	206	218	231	244	253	1.4	1.2
Warrior River System	26	27	30	32	34	36	38	1.6	1.4
Great Lakes	434	437	441	444	446	448	450	0.2	0.1

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON-MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY Pulp Paper and Allied Products
ALTERNATIVE Badenergy2003A

SEGMENT	1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
Upper Mississippi	7	8	8	8	8	9	9	0.9	0.6
Lower Upper Mississippi	12	13	14	15	16	17	18	1.7	1.5
Lower Mississippi	108	112	121	126	132	138	142	1.2	0.9
Baton Rouge to Gulf	55	58	63	66	69	73	75	1.3	1.1
Illinois River	3	3	3	4	4	5	5	2.4	2.1
Missouri River	4	4	4	4	4	4	4	0.8	0.4
Ohio River	10	10	10	11	11	11	11	0.8	0.4
Tennessee River	19	20	21	21	22	23	23	0.9	0.6
Arkansas River	10	11	11	12	12	12	12	0.8	0.5
Gulf Coast West	12	12	13	14	14	15	15	1.0	0.7
Gulf Coast East	29	31	33	36	38	40	42	1.5	1.3
Warrior River System	1	1	1	1	1	1	1	1.6	1.4
Great Lakes	119	120	121	122	122	123	123	0.2	0.1
Total	389	401	424	438	454	471	482	0.9	0.7

a = less than 500,000 ton-miles

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY Chemicals
ALTERNATIVE Radener gy2003A

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Shipped	372	434	598	727	821	1,023	1,112	5.3	3.3
	Received	1,900	2,145	3,102	3,741	4,062	5,113	5,432	5.3	2.9
Lower Upper Mississippi	Shipped	508	559	703	826	1,002	1,369	1,483	3.8	4.6
	Received	873	930	1,151	1,330	1,524	1,804	1,943	3.3	3.0
Lower Mississippi	Shipped	792	870	1,122	1,340	1,507	1,835	1,996	4.1	3.1
	Received	971	1,034	1,255	1,460	1,671	1,928	2,084	3.2	2.8
Baton Rouge to Gulf	Shipped	13,099	14,242	17,670	20,750	23,215	27,076	29,431	3.6	2.7
	Received	4,338	4,705	5,705	6,584	7,506	8,704	9,506	3.3	2.9
Illinois River	Shipped	418	460	564	674	789	937	1,046	3.7	3.4
	Received	3,767	4,353	5,558	6,745	7,718	9,288	10,211	4.6	3.2
Missouri River	Shipped	135	153	209	256	290	364	399	5.1	3.5
	Received	445	451	268	285	305	336	351	1.4	1.6
Ohio River	Shipped	1,916	2,062	2,518	3,119	4,409	6,626	7,450	3.8	6.9
	Received	6,904	7,404	9,299	11,135	13,377	16,733	18,514	3.7	4.0
Tennessee River	Shipped	580	615	741	913	1,160	1,444	1,586	3.5	4.3
	Received	2,038	2,198	2,685	3,146	3,632	4,199	4,611	3.4	3.0
Arkansas River	Shipped	80	85	99	112	124	139	150	2.6	2.3
	Received	516	557	721	845	930	1,112	1,188	3.9	2.7
Gulf Coast West	Shipped	17,780	19,398	23,466	27,225	31,047	35,535	39,043	3.3	2.8
	Received	10,011	10,927	13,115	15,320	17,719	20,343	22,458	3.3	3.0
Gulf Coast East	Shipped	1,195	1,265	1,483	1,735	1,931	2,227	2,389	2.9	2.5
	Received	1,559	1,632	1,832	2,030	2,219	2,477	2,654	2.1	2.1
Warrior River System	Shipped	416	446	530	605	684	776	846	2.9	2.6
	Received	760	803	914	1,016	1,125	1,298	1,403	2.3	2.5
South Atlantic Coast	Shipped	1,028	1,070	555	654	743	852	933	-3.4	2.8
	Received	2,160	2,303	2,026	2,345	2,689	3,107	3,425	0.6	3.0
Middle Atlantic Coast	Shipped	2,740	2,847	3,283	3,729	4,272	4,893	5,363	2.4	2.8
	Received	5,544	5,958	7,047	8,038	9,079	10,420	11,410	2.9	2.7

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SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Shipped	26	27	31	34	38	42	45	2.2	2.1
	Received	663	719	861	990	1,131	1,294	1,418	3.1	2.8
Great Lakes and Seaway	Shipped	629	671	788	927	1,103	1,300	1,460	3.0	3.6
	Received	498	531	618	731	879	1,048	1,183	3.0	3.8
Washington/Oregon Coast	Shipped	786	825	990	1,149	1,320	1,537	1,685	3.0	3.0
	Received	526	553	675	791	915	1,071	1,178	3.2	3.1
Columbia-Snake Willamette River	Shipped	226	238	276	309	343	381	410	2.4	2.2
	Received	697	741	869	992	1,096	1,220	1,317	2.7	2.3
California Coast	Shipped	371	344	420	490	573	665	735	2.2	3.2
	Received	1,049	1,126	1,364	1,570	1,775	2,070	2,264	3.2	2.9
Alaska	Shipped	314	330	389	439	482	548	588	2.6	2.3
	Received	124	131	149	171	196	227	250	2.5	2.9
Hawaii and Pacific Territories	Shipped	27	14	18	22	27	32	36	-1.7	3.9
	Received	212	155	195	232	277	326	361	0.7	3.5
Domestic Caribbean	Shipped	2,654	2,923	3,613	4,236	4,901	5,656	6,259	3.7	3.0
	Received	538	523	653	786	956	1,141	1,282	2.9	3.8
Total	Shipped	46,093	49,878	60,065	70,272	80,781	95,258	104,444	3.3	3.1
	Received	46,093	49,878	60,065	70,272	80,781	95,258	104,444	3.3	3.1

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY Chemicals
ALTERNATIVE Badenergy2003A

SEGMENT	EXP/IMP	1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	3,410	5,051	5,448	4,697	4,480	4,225	4,072	2.5	-1.1
	Imports	1,301	1,198	850	952	1,230	1,500	1,684	-2.4	4.5
Illinois River	Exports	8	12	11	11	12	12	12	2.3	0.2
	Imports	85	78	68	76	96	114	127	-0.8	4.1
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	7,208	10,241	8,861	8,301	8,302	8,248	8,225	1.1	-0.1
	Imports	1,222	1,076	1,124	1,252	1,362	1,665	1,871	0.2	3.1
Gulf Coast East	Exports	4,032	6,413	9,442	7,250	6,313	5,377	4,815	4.6	-3.1
	Imports	736	1,591	1,447	1,495	1,655	1,808	1,913	5.6	1.9
Warrior River System	Exports	45	63	54	51	53	55	56	1.0	0.8
	Imports	10	10	7	8	10	12	13	-1.1	3.3
South Atlantic Coast	Exports	1,021	1,589	1,989	1,723	1,664	1,585	1,539	4.1	-0.9
	Imports	927	884	360	416	512	605	669	-6.0	3.7
Middle Atlantic Coast	Exports	1,809	2,567	2,651	2,726	2,872	2,926	2,961	3.2	0.6
	Imports	2,772	2,534	2,249	2,517	2,755	3,317	3,729	-0.7	3.1

4/16/80

SEGMENT	EXP/IMP	1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
North Atlantic Coast	Exports	20	32	34	36	38	33	40	4.5	0.9
	Imports	111	98	[illegible]	121	153	184	205	0.6	4.2
Great Lakes and Seaway	Exports	78	117	102	103	106	108	109	2.1	.5
	Imports	253	241	114	115	146	176	197	5.9	4.2
Washington Oregon Coast	Exports	105	116	133	137	140	150	156	1.9	1.3
	Imports	1,427	[illegible]	1,348	1,495	1,954	2,387	2,694	0.4	4.6
Columbia Snake Willamette River	Exports	41	57	49	46	47	47	47	0.9	0.1
	Imports	1,371	[illegible]	1,218	1,350	1,775	2,174	2,457	0.1	4.7
California Coast	Exports	1,713	2,328	2,195	2,154	2,207	2,218	2,225	1.8	0.2
	Imports	476	460	265	291	349	408	449	-3.7	3.4
Alaska	Exports	325	367	340	331	331	331	331	0.1	0.0
	Imports	33	40	44	48	57	66	72	2.9	3.1
Hawaii and Pacific Territories	Exports	1	1	1	1	1	1	1	3.4	0.4
	Imports	58	56	11	12	15	19	22	-11.2	4.4
Domestic Caribbean	Exports	992	1,511	1,182	1,102	1,111	1,113	1,114	0.8	0.1
	Imports	76	77	31	35	44	53	59	5.9	4.2
Total	Exports	20,808	30,477	32,491	28,664	27,678	26,434	25,702	2.5	0.8
	Imports	10,857	10,746	9,234	10,183	12,113	14,486	16,159	0.5	3.6

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON-MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY Chemicals
ALTERNATIVE Badenergy2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	788	888	1,278	1,548	1,690	2,123	2,267	5.3	3.0
Lower Upper Mississippi	1,389	1,562	1,989	2,385	2,692	3,285	3,564	4.2	3.1
Lower Mississippi	9,637	10,556	13,259	15,722	17,807	21,099	23,023	3.8	3.0
Baton Rouge to Gulf	2,262	2,461	3,040	3,561	4,012	4,699	5,116	3.6	2.8
Illinois River	937	1,078	1,370	1,660	1,903	2,285	2,514	4.5	3.2
Missouri River	283	296	223	257	285	340	366	0.7	2.8
Ohio River	3,995	4,314	5,393	6,424	7,719	9,660	10,686	3.7	4.0
Tennessee River	578	624	770	917	1,078	1,280	1,415	3.6	3.4
Arkansas River	112	120	154	180	198	235	251	3.7	2.6
Gulf Coast West	3,618	3,932	4,694	5,448	6,243	7,213	7,931	3.2	2.9
Gulf Coast East	458	484	566	640	710	812	875	2.6	2.4
Warrior River System	143	152	174	195	218	249	270	2.4	2.5
Great Lakes	207	220	255	294	340	392	434	2.7	3.0
Total	24,408	26,688	33,166	39,231	44,896	53,672	58,712	3.7	3.1

* = less than 500,000 ton-miles

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL, AND THROUGH
COMMODITY Chemicals
ALTERNATIVE Badenergy2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	2,080	2,348	3,377	4,085	4,462	5,605	*5,982	5.3	3.0
Lower Upper Mississippi	6,863	7,702	9,777	11,712	13,242	16,193	17,566	4.2	3.2
Lower Mississippi	14,878	16,284	20,468	24,264	27,480	32,584	35,535	3.8	3.0
Baton Rouge to Gulf	21,080	22,956	28,344	33,234	37,581	44,006	48,012	3.6	2.9
Illinois River	4,066	4,677	5,945	7,203	8,259	9,923	10,920	4.5	3.3
Missouri River	538	562	431	494	546	648	696	0.7	2.7
Ohio River	9,603	10,326	12,875	15,397	18,596	23,324	25,807	3.7	4.1
Tennessee River	2,484	2,674	3,263	3,869	4,568	5,385	5,919	3.5	3.3
Arkansas River	595	641	820	957	1,054	1,251	1,338	3.7	2.6
Gulf Coast West	21,058	22,962	27,646	32,144	36,855	42,400	46,681	3.3	2.9
Gulf Coast East	3,619	3,818	4,410	4,995	5,526	6,291	6,765	2.5	2.4
Warrior River System	1,140	1,211	1,401	1,574	1,758	2,014	2,184	2.5	2.6
Great Lakes	700	749	881	1,037	1,234	1,455	1,632	3.1	3.5

* = less than 500 tons

4/18/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY Petroleum and Coal Products
ALTERNATIVE Badenergy2003A

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77 90	90 03
Upper Mississippi	Shipped	1,399	1,468	1,525	1,585	1,682	1,761	1,804	1.0	1.0
	Received	3,035	3,128	3,170	3,227	3,344	3,436	3,482	0.5	0.6
Lower Upper Mississippi	Shipped	6,334	6,450	6,379	6,435	6,584	6,735	6,823	0.1	0.5
	Received	2,891	2,940	2,859	2,814	2,880	2,952	3,000	-0.2	0.5
Lower Mississippi	Shipped	2,006	2,033	2,105	2,203	2,274	2,308	2,311	0.7	0.4
	Received	8,807	8,696	8,702	8,900	8,865	8,817	8,795	0.1	-0.1
Baton Rouge to Gulf	Shipped	43,713	43,472	41,227	43,884	43,231	42,855	42,984	0.0	-0.2
	Received	19,215	19,350	20,878	23,928	23,487	23,287	23,563	1.7	-0.1
Illinois River	Shipped	3,499	3,529	3,481	3,540	3,626	3,708	3,783	0.1	0.5
	Received	6,551	6,562	6,366	6,403	6,557	6,734	6,886	-0.2	0.6
Missouri River	Shipped	168	184	194	206	224	244	257	1.6	1.7
	Received	268	293	308	326	352	382	403	1.5	1.6
Ohio River	Shipped	9,805	9,778	9,523	9,493	9,535	9,573	9,583	-0.2	0.1
	Received	19,035	19,064	18,689	18,937	19,231	19,572	19,784	0.0	0.3
Tennessee River	Shipped	184	187	194	201	206	208	208	0.7	0.3
	Received	1,941	1,932	2,067	2,243	2,403	2,576	2,698	1.1	1.4
Arkansas River	Shipped	1,084	1,061	930	832	767	713	696	-2.0	-1.4
	Received	1,422	1,438	1,353	1,309	1,214	1,131	1,099	-0.6	-1.3
Gulf Coast West	Shipped	81,572	81,178	71,098	74,178	73,355	73,358	73,975	-0.7	0.0
	Received	21,623	22,097	23,829	26,730	27,075	27,668	28,362	1.6	0.5
Gulf Coast East	Shipped	12,002	11,750	11,280	11,303	11,003	10,954	11,009	-0.5	-0.2
	Received	19,146	18,552	17,718	17,524	16,956	16,788	16,807	-0.7	-0.3
Warrior River System	Shipped	2,602	2,691	2,860	3,108	3,205	3,329	3,427	1.4	0.8
	Received	3,120	3,140	3,077	3,144	3,209	3,304	3,376	0.1	0.5
South Atlantic Coast	Shipped	7,094	6,274	5,457	5,051	3,967	3,521	3,508	-2.6	-2.8
	Received	31,994	31,006	29,626	29,239	28,134	27,862	27,948	-0.7	-0.3
Middle Atlantic Coast	Shipped	112,406	110,186	105,169	101,815	94,902	88,647	85,472	-0.8	-1.3
	Received	129,100	126,982	113,543	111,810	105,048	98,888	95,935	-1.1	-1.2

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SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Shipped	8,500	8,775	8,718	8,422	7,892	7,275	6,976	-0.1	-1.4
	Received	48,247	48,930	44,112	43,348	41,984	40,324	39,366	-0.8	-0.7
Great Lakes and Seaway	Shipped	5,760	5,651	5,336	5,219	5,141	5,037	4,991	-0.8	-0.3
	Received	6,846	6,784	6,599	6,533	6,452	6,346	6,300	-0.4	-0.3
Washington/Oregon Coast	Shipped	5,774	5,224	5,696	6,144	6,084	5,937	5,874	0.5	-0.3
	Received	5,884	5,335	5,815	6,275	6,228	6,100	6,053	0.5	-0.3
Columbia-Snake Willamette River	Shipped	2,130	1,821	2,004	2,162	2,090	1,987	1,941	0.1	-0.8
	Received	5,397	4,813	5,162	5,466	5,293	5,075	4,976	0.1	-0.7
California Coast	Shipped	26,329	21,019	23,886	26,388	24,824	22,926	22,160	0.0	-1.3
	Received	22,495	17,191	19,969	22,380	20,826	18,957	18,215	0.0	-1.6
Alaska	Shipped	2,117	1,870	2,120	2,347	2,296	2,209	2,175	0.8	-0.6
	Received	2,075	2,072	2,293	2,501	2,575	2,609	2,622	1.4	0.4
Hawaii and Pacific Territories	Shipped	1,574	1,291	1,402	1,505	1,391	1,271	1,223	-0.3	-1.6
	Received	1,995	1,674	1,789	1,898	1,767	1,631	1,575	-0.4	-1.4
Domestic Caribbean	Shipped	28,364	29,414	30,671	32,239	32,929	33,211	33,393	1.0	0.3
	Received	3,329	3,329	3,329	3,329	3,329	3,329	3,329	0.0	0.0
Total	Shipped	364,418	355,308	341,254	348,262	337,207	327,767	324,572	-0.3	-0.5
	Received	364,418	355,308	341,254	348,262	337,207	327,767	324,572	-0.3	-0.5

* = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY: Petroleum and Coal Products
ALTERNATIVE: Badenerg,2003A

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	1,08	988	848	729	626	537	490	3.0	-3.0
	Imports	278	265	265	269	255	245	242	-0.2	0.8
Illinois River	Exports	500	456	392	337	289	248	227	-3.0	-3.0
	Imports	a	a	a	a	a	a	a	0.0	0.0
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	3,520	3,213	2,759	2,369	2,034	1,747	1,595	-3.0	-3.0
	Imports	2,117	2,046	2,024	2,026	1,958	1,904	1,885	-0.3	-0.6
Gulf Coast East	Exports	1,250	1,141	980	841	723	620	566	-3.0	-3.0
	Imports	2,981	2,609	2,466	2,457	2,110	1,832	1,736	1.5	-2.6
Warrior River System	Exports	3	2	2	2	2	1	1	-3.0	-3.0
	Imports	9	8	8	9	8	8	8	-0.2	-1.0
South Atlantic Coast	Exports	27	25	21	18	16	13	12	3.0	-3.0
	Imports	10,434	8,976	8,392	8,338	6,987	5,900	5,524	-1.7	-3.1
Middle Atlantic Coast	Exports	533	486	417	358	308	264	241	-3.0	3.0
	Imports	46,646	41,159	38,962	38,761	33,673	29,579	28,164	-1.4	-2.4

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SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Exports	35	32	27	23	20	17	16	-3.0	-3.0
	Imports	17,571	15,581	14,783	14,710	12,865	11,380	10,867	-1.4	2.3
Great Lakes and Seaway	Exports	71	65	56	48	41	35	32	-3.0	-3.0
	Imports	2,135	2,130	2,127	2,127	2,122	2,118	2,116	0.0	0.0
Washington/Oregon Coast	Exports	2	2	1	1	1	1	1	-3.0	-3.0
	Imports	123	110	105	104	92	82	78	-1.3	-2.2
Columbia-Snake Willamette River	Exports	15	13	12	10	9	7	7	-3.0	-3.0
	Imports	30	27	26	26	23	21	20	-1.2	-2.0
California Coast	Exports	3,852	3,515	3,019	2,592	2,226	1,912	1,745	-3.0	-3.0
	Imports	1,602	1,429	1,362	1,358	1,197	1,067	1,022	-1.3	-2.2
Alaska	Exports	1,089	994	854	733	630	541	493	-3.0	-3.0
	Imports	737	737	737	737	737	737	737	0.0	0.0
Hawaii and Pacific Territories	Exports	32	29	25	21	18	16	14	-3.0	-3.0
	Imports	3,129	2,916	2,844	2,848	2,644	2,483	2,428	-0.7	-1.2
Domestic Caribbean	Exports	8	7	6	5	5	4	4	-3.0	-3.0
	Imports	6,079	5,769	5,792	5,900	5,553	5,305	5,217	0.2	-0.9
Total	Exports	12,019	10,969	9,420	8,089	6,946	5,965	5,444	-3.0	-3.0
	Imports	93,871	83,763	79,895	79,670	70,224	62,661	60,045	-1.3	-2.2

a * less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC INBOUND, OUTBOUND, LOCAL, AND THROUGH
COMMODITY Petroleum and Coal Products
ALTERNATIVE Badenergy2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	3,124	3,229	3,280	3,351	3,484	3,596	3,657	0.5	0.7
Lower Upper Mississippi	12,091	12,349	12,288	12,511	12,967	13,526	13,931	0.3	0.8
Lower Mississippi	24,229	24,267	24,291	25,117	25,609	26,248	26,753	0.3	0.5
Baton Rouge to Gulf	59,813	59,705	58,038	62,149	61,668	61,791	62,520	0.3	0.0
Illinois River	8,352	8,390	8,220	8,331	8,560	8,839	9,079	0.0	0.7
Missouri River	436	478	502	532	576	626	660	1.6	1.7
Ohio River	22,294	22,349	22,119	22,580	23,072	23,631	23,993	0.1	0.5
Tennessee River	2,121	2,114	2,256	2,438	2,602	2,776	2,897	1.1	1.3
Arkansas River	2,075	2,025	1,888	1,822	1,680	1,557	1,512	-1.0	-1.4
Gulf Coast West	89,324	89,094	79,446	83,276	82,594	82,861	83,754	-0.5	0.0
Gulf Coast East	27,929	27,408	26,597	26,813	26,319	26,324	26,510	-0.3	-0.1
Warrior River System	5,475	5,583	5,680	5,975	6,123	6,328	6,488	0.7	0.6
Great Lakes	7,924	7,802	7,529	7,415	7,297	7,156	7,095	-0.5	-0.3

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON-MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY Petroleum and Coal Products
ALTERNATIVE Badenergy2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	730	750	755	765	789	811	824	0.4	0.6
Lower Upper Mississippi	1,712	1,746	1,743	1,788	1,864	1,962	2,036	0.3	1.0
Lower Mississippi	12,512	12,598	12,616	13,071	13,454	13,944	14,314	0.3	0.7
Baton Rouge to Gulf	6,610	6,562	6,039	6,326	6,243	6,225	6,275	0.3	-0.1
Illinois River	1,355	1,360	1,336	1,356	1,395	1,448	1,492	0.0	0.7
Missouri River	92	101	106	112	121	132	139	1.6	1.7
Ohio River	8,414	8,377	8,171	8,356	8,473	8,658	8,806	-0.1	0.4
Tennessee River	645	635	663	707	751	803	841	0.7	1.3
Arkansas River	490	481	446	427	394	366	355	-1.1	-1.4
Gulf Coast West	9,998	9,978	9,722	10,275	10,265	10,424	10,645	0.2	0.3
Gulf Coast East	2,413	2,362	2,279	2,282	2,238	2,235	2,247	-0.4	-0.1
Warrior River System	223	227	231	245	252	261	268	0.7	0.7
Great Lakes	1,800	1,769	1,682	1,649	1,634	1,608	1,595	-0.7	-0.3
Total	46,994	46,947	45,789	47,359	47,873	48,877	49,837	0.1	0.4

* = less than 500,000 ton-miles

4/16/80.

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC
COMMODITY Stone, Clay, Glass, and Concrete Products
ALTERNATIVE Badenergy2003A

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Shipped	1,372	1,412	1,629	1,650	1,650	1,713	1,777	1.4	0.6
	Received	407	419	484	490	490	509	528	1.4	0.6
Lower Upper Mississippi	Shipped	1,411	1,523	1,915	2,041	2,167	2,396	2,583	2.9	1.8
	Received	198	204	235	238	278	246	256	1.4	0.6
Lower Mississippi	Shipped	5	6	8	9	11	12	14	4.7	2.9
	Received	1,057	1,145	1,447	1,545	1,646	1,825	1,971	3.0	1.9
Baton Rouge to Gulf	Shipped	57	60	71	74	76	81	86	2.0	1.1
	Received	84	87	103	106	108	115	121	1.9	1.0
Illinois River	Shipped	68	71	86	89	92	98	104	2.1	1.2
	Received	1,095	1,173	1,458	1,543	1,626	1,784	1,916	2.7	1.7
Missouri River	Shipped	147	152	175	177	177	183	190	1.4	0.6
	Received	148	153	176	179	179	186	193	1.5	0.6
Ohio River	Shipped	1,173	1,291	1,677	1,817	1,966	2,214	2,412	3.4	2.2
	Received	1,105	1,193	1,500	1,598	1,697	1,876	2,023	2.9	1.8
Tennessee River	Shipped	19	22	32	36	41	48	54	5.2	3.2
	Received	66	68	80	82	83	87	91	1.7	0.8
Arkansas River	Shipped	3	3	5	6	6	8	8	5.6	3.3
	Received	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Shipped	246	254	294	299	300	313	325	1.5	0.6
	Received	413	435	519	538	553	592	626	2.1	1.2
Gulf Coast East	Shipped	580	679	966	1,094	1,240	1,457	1,624	5.0	3.1
	Received	592	657	865	945	1,030	1,169	1,278	3.7	2.4
Warrior River System	Shipped	129	134	155	159	159	167	174	1.6	0.7
	Received	216	250	351	395	445	519	577	4.7	3.0
South Atlantic Coast	Shipped	141	159	201	226	244	280	304	3.7	2.3
	Received	410	454	573	669	724	8[illegible]	902	3.8	2.3
Middle Atlantic Coast	Shipped	1,938	2,144	2,707	3,164	3,419	3,965	4,261	3.8	2.3
	Received	947	1,048	1,324	1,546	1,671	1,938	2,082	3.8	2.3

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4/16/80

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Shipped	17	19	24	28	31	35	38	3.9	2.3
	Received	634	700	884	1,038	1,121	1,302	1,398	3.9	2.3
Great Lakes and Seaway	Shipped	3,603	3,883	4,411	4,997	5,430	5,903	6,168	2.5	1.6
	Received	3,449	3,725	4,230	4,815	5,248	5,716	5,975	2.6	1.7
Washington/Oregon Coast	Shipped	399	437	545	592	630	704	759	3.1	1.9
	Received	255	273	337	362	381	420	450	2.7	1.7
Columbia-Snake Willamette River	Shipped	25	29	39	43	48	55	61	4.4	2.8
	Received	15	17	24	28	32	37	41	5.0	3.0
California Coast	Shipped	162	184	232	257	278	317	345	3.6	2.3
	Received	33	37	47	53	57	65	71	3.6	2.3
Alaska	Shipped	6	7	9	10	11	12	13	3.7	2.3
	Received	186	209	264	297	321	368	399	3.7	2.3
Hawaii and Pacific Territories	Shipped	117	130	165	190	205	237	255	3.8	2.3
	Received	229	259	328	365	395	451	490	3.6	2.3
Domestic Caribbean	Shipped	35	35	35	36	36	36	36	0.0	0.1
	Received	116	127	152	162	172	191	205	2.6	1.9
Total	Shipped	11,655	12,633	15,380	16,992	18,217	20,235	21,591	2.9	1.9
	Received	11,655	12,633	15,380	16,992	18,217	20,235	21,591	2.9	1.9

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY Stone, Clay, Glass, and Concrete Products
ALTERNATIVE Badener/2003A

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	82	92	108	122	138	158	171	3.1	2.6
	Imports	125	217	172	175	174	180	187	2.6	0.5
Illinois River	Exports	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.0	2.6
	Imports	13	19	16	16	16	16	17	1.6	0.3
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	50	57	68	77	88	102	111	3.5	2.8
	Imports	225	380	304	308	307	317	328	2.4	0.5
Gulf Coast East	Exports	37	43	50	57	65	74	81	3.3	2.7
	Imports	219	410	318	322	322	335	348	3.0	0.6
Warrior River System	Exports	19	21	25	28	32	36	39	3.1	2.6
	Imports	3	3	3	3	3	3	3	0.0	0.0
South Atlantic Coast	Exports	123	139	165	186	212	242	264	3.2	2.7
	Imports	545	957	758	767	766	793	821	2.7	0.5
Middle Atlantic Coast	Exports	316	348	406	454	512	581	629	2.8	2.5
	Imports	704	999	849	855	854	872	891	1.5	0.3

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4/16/80

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77 90	90 03
North Atlantic	Exports	2	2	3	3	3	4	4	2.7	2.5
Coast	Imports	12	13	12	12	12	12	12	0.0	0.0
Great Lakes and	Exports	50	69	89	106	126	150	167	6.0	3.6
Seaway	Imports	777	1,446	1,124	1,139	1,138	1,182	1,227	3.0	0.6
Washington-Oregon	Exports	21	29	38	45	54	65	72	6.2	3.6
Coast	Imports	730	1,316	1,033	1,046	1,045	1,083	1,123	2.8	0.5
Columbia Snake	Exports	1	1	1	1	1	1	2	2.8	2.5
Willamette River	Imports	14	14	14	14	14	14	14	0.0	0.0
California Coast	Exports	36	40	47	53	60	68	74	3.0	2.6
	Imports	277	294	279	280	280	280	280	0.1	0.0
Alaska	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	79	133	107	108	108	111	115	2.4	0.5
Hawaii and Pacific	Exports	a	a	a	a	a	a	1	3.1	2.7
Territories	Imports	4	5	4	4	4	4	4	0.0	0.0
Domestic Caribbean	Exports	50	68	88	105	124	148	165	5.[illegible]	3.5
	Imports	57	88	73	73	73	75	77	1.9	0.4
Total	Exports	787	911	1,089	1,239	1,416	1,630	1,779	3.6	2.8
	Imports	3,783	6,294	5,066	5,121	5,117	5,279	5,447	2.4	0.5

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC INBOUND, OUTBOUND, LOCAL, AND THROUGH
COMMODITY Stone, Clay, Glass, and Concrete Products
ALTERNATIVE Badenergy2003A

SEGMENT	YEARS 1977	1980	1985	1990	1995	2000	2003	% GROWTH 77 90	90 03
Upper Mississippi	1,390	1,430	1,650	1,672	1,672	1,736	1,802	1.4	0.6
Lower Upper Mississippi	2,055	2,188	2,686	2,824	2,954	3,217	3,437	2.5	1.5
Lower Mississippi	1,343	1,440	1,790	1,896	1,999	2,194	2,356	2.7	1.7
Baton Rouge to Gulf	366	380	445	455	460	484	507	1.7	0.8
Illinois River	1,181	1,263	1,564	1,652	1,738	1,903	2,040	2.6	1.6
Missouri River	148	153	176	179	179	186	193	1.5	0.6
Ohio River	1,709	1,871	2,407	2,596	2,795	3,132	3,402	3.3	2.1
Tennessee River	82	87	107	112	117	127	135	2.4	1.5
Arkansas River	3	3	5	6	6	8	8	5.6	3.3
Gulf Coast West	436	460	549	569	586	627	663	2.1	1.2
Gulf Coast East	945	1,056	1,403	1,540	1,688	1,925	2,111	3.8	2.5
Warrior River System	343	381	503	550	601	683	747	3.7	2.4
Great Lakes	3,613	3,893	4,425	5,011	5,445	5,920	6,186	2.5	1.6

* = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON-MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY Stone, Clay, Glass, and Concrete Products
ALTERNATIVE Badenergy2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	229	236	272	275	275	286	296	1.4	0.6
Lower Upper Mississippi	283	301	367	385	401	436	465	2.4	1.5
Lower Mississippi	467	496	607	637	665	722	771	2.4	1.5
Baton Rouge to Gulf	46	48	57	58	59	63	66	1.8	1.0
Illinois River	313	335	414	437	460	503	539	2.6	1.6
Missouri River	38	39	45	46	46	48	50	1.4	0.6
Ohio River	474	529	702	769	842	959	1,051	3.8	2.4
Tennessee River	33	36	44	47	49	53	57	2.6	1.6
Arkansas River	1	1	2	2	2	3	3	5.6	3.3
Gulf Coast West	46	48	57	59	61	65	69	2.0	1.1
Gulf Coast East	61	67	88	95	103	116	127	3.5	2.2
Warrior River System	11	12	16	17	19	21	23	3.5	2.3
Great Lakes	1,579	1,703	1,935	2,197	2,390	2,601	2,718	2.6	1.7
Total	3,582	3,852	4,606	5,025	5,374	5,876	6,235	2.6	1.7

a = less than 500,000 ton-miles

4/17/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY Primary Metals Products
ALTERNATIVE Badenergy2003A

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Shipped	62	63	64	65	66	67	68	0.3	0.4
	Received	294	292	341	377	408	444	466	1.9	1.6
Lower Upper Mississippi	Shipped	180	184	203	221	239	262	277	1.6	1.8
	Received	510	508	601	671	734	808	856	2.1	1.9
Lower Mississippi	Shipped	37	37	39	41	43	45	46	0.8	0.9
	Received	538	527	653	742	815	896	945	2.5	1.9
Baton Rouge to Gulf	Shipped	2,596	2,543	3,356	3,951	4,452	5,001	5,336	3.3	2.3
	Received	386	397	382	387	401	419	433	0.0	0.9
Illinois River	Shipped	813	825	880	929	981	1,043	1,086	1.0	1.2
	Received	1,126	1,118	1,304	1,442	1,560	1,691	1,772	1.9	1.6
Missouri River	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	77	75	93	104	114	124	129	2.3	1.7
Ohio River	Shipped	1,998	2,043	2,281	2,489	2,698	2,952	3,123	1.7	1.8
	Received	1,980	2,023	2,427	2,758	3,076	3,442	3,680	2.6	2.2
Tennessee River	Shipped	149	149	152	154	157	160	162	0.3	0.4
	Received	333	340	389	430	470	517	548	2.0	1.9
Arkansas River	Shipped	4	4	5	5	5	5	5	0.6	0.8
	Received	340	334	400	447	484	526	550	2.1	1.6
Gulf Coast West	Shipped	797	805	842	875	909	950	978	0.7	0.9
	Received	1,507	1,530	1,710	1,859	2,003	2,174	2,288	1.6	1.6
Gulf Coast East	Shipped	107	116	139	162	187	217	238	3.2	3.0
	Received	58	58	67	74	81	88	93	1.9	1.7
Warrior River System	Shipped	104	105	112	117	123	130	135	0.9	1.1
	Received	167	163	192	213	228	245	254	1.9	1.4
South Atlantic Coast	Shipped	125	125	125	125	125	125	125	0.0	0.0
	Received	76	76	76	76	76	76	76	0.0	0.0
Middle Atlantic Coast	Shipped	614	584	573	561	550	538	531	-0.7	-0.4
	Received	553	468	456	445	433	422	415	-1.7	-0.5

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SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Shipped	13	12	13	13	13	13	13	0.0	0.0
	Received	4	4	4	4	4	4	4	0.0	0.0
Great Lakes and Seaway	Shipped	1,246	1,262	1,317	1,371	1,429	1,499	1,547	0.7	0.9
	Received	758	754	810	851	885	923	947	0.9	0.8
Washington/Oregon Coast	Shipped	173	79	79	79	79	79	79	5.8	0.0
	Received	36	20	20	20	20	20	20	-4.4	0.0
Columbia Snake Willamette River	Shipped	11	10	10	10	10	10	10	-1.0	0.0
	Received	1	0	0	0	0	0	0	-100.0	0.0
California Coast	Shipped	70	70	70	70	70	70	70	0.0	0.0
	Received	32	8	8	8	8	8	8	-9.9	0.0
Alaska	Shipped	4	4	4	4	4	4	4	-1.6	0.0
	Received	63	63	63	63	63	63	63	0.0	0.0
Hawaii and Pacific Territories	Shipped	12	11	11	11	11	11	11	-0.3	0.0
	Received	96	96	96	96	96	96	96	0.0	0.0
Domestic Caribbean	Shipped	12	12	12	12	12	12	12	0.0	0.0
	Received	191	192	196	199	203	208	211	0.3	0.5
Total	Shipped	9,127	9,046	10,287	11,266	12,163	13,194	13,855	1.6	1.6
	Received	9,127	9,046	10,287	11,266	12,163	13,194	13,855	1.6	1.6

* = less than 500 tons

4/17/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY Primary Metals Products
ALTERNATIVE Badenerg, 2003A

SEGMENT	EXP/IMP	1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	371	367	311	296	297	303	308	1.7	0.3
	Imports	3,623	3,752	5,175	6,095	6,915	7,830	8,402	4.1	2.5
Illinois River	Exports	139	178	169	167	167	168	169	1.4	0.1
	Imports	1,909	1,239	1,683	1,881	2,023	2,160	2,228	-0.1	1.3
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	328	317	257	241	242	248	254	-2.4	0.4
	Imports	2,542	2,327	3,159	3,696	4,071	4,456	4,665	2.9	1.8
Gulf Coast East	Exports	109	105	81	74	75	77	80	-2.9	0.5
	Imports	324	312	411	481	538	596	630	3.1	2.1
Warrior River System	Exports	67	64	50	46	46	48	49	-2.8	0.5
	Imports	201	187	256	303	338	377	400	3.2	2.2
South Atlantic Coast	Exports	240	272	226	212	214	218	223	0.9	0.4
	Imports	902	773	1,029	1,189	1,295	1,399	1,451	2.1	1.5
Middle Atlantic Coast	Exports	1,036	1,195	1,044	1,002	1,006	1,021	1,036	-0.3	0.3
	Imports	3,648	4,172	5,803	6,477	7,090	7,729	8,096	4.5	1.7

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Exports	22	23	22	22	22	22	22	0.2	0.1
	Imports	752	659	903	1,057	1,168	1,282	1,345	2.6	1.9
Great Lakes and Seaway	Exports	256	344	319	312	313	316	318	1.5	0.1
	Imports	4,841	4,661	6,433	6,892	7,343	7,779	8,008	2.8	1.2
Washington/Oregon Coast	Exports	72	80	75	74	74	74	75	0.2	0.1
	Imports	307	304	416	488	539	592	621	3.6	1.9
Columbia Snake Willamette River	Exports	18	22	20	19	19	19	20	0.4	0.2
	Imports	501	490	659	764	830	892	921	3.3	1.5
California Coast	Exports	117	175	141	132	133	136	139	0.9	0.4
	Imports	2,597	2,557	3,457	4,024	4,403	4,776	4,966	3.4	1.6
Alaska	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	19	20	26	29	31	32	32	3.3	0.7
Hawaii and Pacific Territories	Exports	a	a	a	a	a	a	a	-1.4	0.4
	Imports	74	77	101	113	118	122	123	3.3	0.7
Domestic Caribbean	Exports	12	13	11	10	10	10	11	-1.5	0.4
	Imports	173	182	238	268	282	295	300	3.4	0.9
Total	Exports	2,788	3,155	2,727	2,606	2,617	2,660	2,703	-0.5	0.3
	Imports	22,412	21,712	29,750	33,757	36,983	40,317	42,190	3.2	1.7

a = less than 500 tons

4/17/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL, AND THROUGH
COMMODITY Primary Metals Products
ALTERNATIVE Basenergy2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	356	355	405	442	474	511	535	1.7	1.5
Lower Upper Mississippi	2,689	2,698	3,186	3,569	3,918	4,320	4,578	2.2	1.9
Lower Mississippi	4,214	4,225	5,149	5,872	6,522	7,260	7,726	2.6	2.1
Baton Rouge to Gulf	4,060	4,051	4,987	5,709	6,350	7,068	7,519	2.7	2.1
Illinois River	2,410	2,426	2,778	3,061	3,322	3,625	3,820	1.9	1.7
Missouri River	77	75	93	104	114	124	139	2.3	1.7
Ohio River	3,518	3,597	4,194	4,694	5,181	5,752	6,127	2.2	2.1
Tennessee River	479	486	538	582	624	674	707	1.5	1.5
Arkansas River	342	336	402	449	487	528	553	2.1	1.6
Gulf Coast West	1,752	1,778	1,969	2,129	2,284	2,470	2,593	1.5	1.5
Gulf Coast East	314	320	385	439	490	549	587	2.6	2.3
Warrior River System	227	224	260	286	308	331	345	1.8	1.4
Great Lakes	1,457	1,469	1,580	1,675	1,767	1,876	1,947	1.1	1.2

* = less than 500 tons

4/17/80

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY Primary Metals Products
ALTERNATIVE Radenergy2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	179	178	203	222	238	257	269	1.7	1.5
Lower Upper Mississippi	526	527	626	704	774	855	906	2.3	2.0
Lower Mississippi	2,554	2,567	3,134	3,582	3,989	4,452	4,746	2.6	2.2
Baton Rouge to Gulf	636	625	776	888	983	1,088	1,152	2.6	2.0
Illinois River	442	447	514	570	622	683	722	2.0	1.8
Missouri River	30	30	36	41	45	49	51	2.3	1.7
Ohio River	2,160	2,233	2,619	2,955	3,294	3,694	3,960	2.4	2.3
Tennessee River	120	121	140	155	169	185	196	2.0	1.9
Arkansas River	106	104	124	139	150	163	171	2.1	1.6
Gulf Coast West	323	330	372	407	443	485	512	1.8	1.8
Gulf Coast East	26	26	32	35	39	43	45	2.3	1.8
Warrior River System	35	34	38	41	43	45	47	1.2	1.1
Great Lakes	266	266	266	266	266	266	266	0.0	0.0
Total	7,403	7,488	8,880	10,004	11,055	12,263	13,043	2.3	2.1

a = less than 500,000 ton-miles

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY Waste and Scrap
ALTERNATIVE Badenergy2003A

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Shipped	33	36	41	45	44	44	44	2.5	0.2
	Received	2	2	2	2	2	2	2	1.8	0.7
Lower Upper Mississippi	Shipped	68	71	81	90	91	94	95	2.2	0.4
	Received	134	143	158	169	163	164	163	1.8	0.3
Lower Mississippi	Shipped	72	77	89	99	98	100	100	2.4	0.1
	Received	38	33	29	25	21	19	18	3.3	2.5
Baton Rouge to Gulf	Shipped	139	135	134	133	122	117	113	0.4	1.2
	Received	111	102	99	94	90	87	85	1.3	0.8
Illinois River	Shipped	985	928	882	851	789	751	712	-1.1	1.2
	Received	795	729	657	606	549	514	496	2.1	1.5
Missouri River	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	8	37	74	110	111	111	111	22.2	0.1
Ohio River	Shipped	241	253	298	335	353	363	367	2.5	0.7
	Received	276	275	313	340	364	373	377	1.6	0.8
Tennessee River	Shipped	56	55	58	60	59	58	59	0.5	0.3
	Received	38	37	44	47	49	51	52	1.8	0.7
Arkansas River	Shipped	20	21	26	29	29	30	30	3.0	0.3
	Received	1	1	2	2	2	2	2	1.8	0.7
Gulf Coast West	Shipped	830	721	580	468	378	309	274	4.3	-4.0
	Received	1,354	1,258	1,174	1,090	951	867	822	-1.7	-2.1
Gulf Coast East	Shipped	67	69	77	82	77	76	75	1.5	-0.7
	Received	14	14	15	16	14	14	14	0.8	0.9
Warrior River System	Shipped	374	390	446	475	444	438	432	1.9	0.7
	Received	25	26	29	31	29	29	28	1.9	0.7
South Atlantic Coast	Shipped	32	34	40	40	41	41	41	1.7	0.0
	Received	55	57	65	69	65	64	63	1.8	0.7
Middle Atlantic Coast	Shipped	9,057	9,130	9,376	9,342	9,432	9,438	9,415	0.2	0.1
	Received	9,101	9,184	9,467	9,424	9,534	9,541	9,516	0.3	0.1

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SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Shipped	54	64	96	92	104	105	102	4.1	0.8
	Received	7	7	7	7	7	7	7	0.0	0.0
Great Lakes and Seaway	Shipped	116	121	135	146	150	155	157	1.8	0.5
	Received	204	217	249	278	286	299	305	2.4	0.7
Washington/Oregon Coast	Shipped	1,836	1,754	1,642	1,555	1,487	1,435	1,410	-1.3	-0.7
	Received	1,873	1,790	1,678	1,591	1,523	1,471	1,446	-1.2	-0.7
Columbia-Snake Willamette River	Shipped	59	50	39	30	24	18	16	-4.9	-4.9
	Received	59	51	39	31	24	19	16	-4.9	-4.8
California Coast	Shipped	12	12	14	14	14	14	14	1.1	0.3
	Received	26	26	26	26	26	26	26	0.0	0.0
Alaska	Shipped	26	26	26	26	26	26	26	0.0	0.0
	Received	2	2	2	2	2	2	2	0.0	0.0
Hawaii and Pacific Territories	Shipped	34	34	34	34	34	34	34	0.0	0.0
	Received	8	8	8	8	8	8	8	0.0	0.0
Domestic Caribbean	Shipped	221	226	230	229	230	230	230	0.3	0.0
	Received	202	205	205	205	205	205	205	0.1	0.0
Total	Shipped	14,333	14,207	14,342	14,173	14,026	13,876	13,765	-0.1	-0.2
	Received	14,333	14,207	14,342	14,173	14,026	13,876	13,765	-0.1	-0.2

* = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY Waste and Scrap
ALTERNATIVE Radenerg,2003A

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	265	351	443	448	454	460	465	4.1	0.3
	Imports	166	207	260	327	398	507	587	5.4	4.6
Illinois River	Exports	16	21	27	27	27	27	27	4.1	0.2
	Imports	7	8	11	13	16	21	24	5.4	4.6
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	100	127	161	172	185	201	212	4.3	1.6
	Imports	71	89	111	140	170	217	251	5.4	4.6
Gulf Coast East	Exports	142	188	235	241	249	258	264	4.2	0.7
	Imports	2	3	4	5	6	7	8	5.3	4.6
Warrior River System	Exports	43	57	72	73	75	77	79	4.1	0.6
	Imports	0	0	0	0	0	0	0	0.0	0.0
South Atlantic Coast	Exports	275	337	419	448	480	517	541	3.8	1.5
	Imports	54	65	79	97	115	144	165	4.5	4.2
Middle Atlantic Coast	Exports	2,232	2,904	3,649	3,729	3,819	3,921	3,989	4.0	0.5
	Imports	141	171	210	259	310	389	447	4.8	4.3

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SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Exports	975	1,286	1,621	1,640	1,661	1,684	1,700	4.1	0.3
	Imports	9	10	10	10	10	10	10	0.1	0.1
Great Lakes and Seaway	Exports	288	382	482	485	489	493	495	4.1	0.2
	Imports	96	120	150	189	230	294	340	5.4	4.6
Washington/Oregon Coast	Exports	240	304	392	437	491	558	605	4.7	2.5
	Imports	29	37	46	57	70	89	102	5.3	4.6
Columbia Snake Willamette River	Exports	200	262	333	344	358	375	387	4.3	0.9
	Imports	a	a	a	a	a	a	a	2.1	2.4
California Coast	Exports	1,940	2,523	3,217	3,390	3,599	3,857	4,039	4.4	1.4
	Imports	50	60	72	88	105	131	150	4.5	4.2
Alaska	Exports	a	a	a	a	a	a	a	4.1	0.2
	Imports	7	7	7	7	7	7	7	0.1	0.0
Hawaii and Pacific Territories	Exports	32	39	49	56	64	73	80	4.4	2.8
	Imports	a	a	a	a	a	a	a	0.1	0.0
Domestic Caribbean	Exports	69	82	105	121	140	164	180	4.5	3.1
	Imports	1	2	2	3	3	4	5	5.0	4.4
Total	Exports	6,817	8,861	11,204	11,611	12,090	12,666	13,064	4.2	0.9
	Imports	634	779	962	1,196	1,439	1,820	2,097	5.0	4.4

a = less than 500 tons

4/16/8?

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL, AND THROUGH
COMMODITY Waste and Scrap
ALTERNATIVE Badenergy2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	34	37	43	47	46	46	46	2.5	-0.1
Lower Upper Mississippi	436	476	556	625	620	628	631	2.8	0.1
Lower Mississippi	325	325	347	362	351	347	344	0.8	-0.4
Baton Rouge to Gulf	390	373	372	366	340	326	319	-0.5	-1.1
Illinois River	1,129	1,082	1,064	1,058	1,002	976	962	-0.5	-0.7
Missouri River	8	37	74	110	111	111	111	22.2	0.1
Ohio River	397	408	473	522	548	562	568	2.1	0.6
Tennessee River	94	92	101	107	108	109	109	1.0	0.2
Arkansas River	20	21	26	29	29	30	30	3.0	0.1
Gulf Coast West	1,430	1,327	1,241	1,152	1,010	923	876	-1.6	-2.1
Gulf Coast East	434	452	513	546	511	504	496	1.8	-0.7
Warrior River System	381	397	454	483	452	446	440	1.9	-0.7
Great Lakes	242	257	296	330	340	355	362	2.4	0.7

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY Waste and Scrap
ALTERNATIVE Badenergy2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	16	18	20	22	22	22	22	2.5	-0.1
Lower Upper Mississippi	70	73	84	92	91	92	92	2.1	0.0
Lower Mississippi	177	177	189	197	190	188	187	0.8	-0.4
Baton Rouge to Gulf	53	51	52	52	49	47	46	-0.2	-0.8
Illinois River	214	208	210	213	204	201	200	0.0	-0.5
Missouri River	3	14	27	40	41	41	41	22.2	0.1
Ohio River	262	268	312	345	366	377	382	2.1	0.8
Tennessee River	18	19	22	24	26	26	27	2.3	0.7
Arkansas River	5	6	7	8	8	8	8	3.0	0.3
Gulf Coast West	275	271	283	285	260	250	243	0.3	-1.2
Gulf Coast East	51	53	61	65	61	60	59	1.8	-0.7
Warrior River System	136	142	162	173	162	159	157	1.9	-0.7
Great Lakes	48	51	59	65	67	71	72	2.4	0.7
Total	1,329	1,350	1,486	1,580	1,546	1,542	1,535	1.3	-0.2

= less than 500,000 ton-miles

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY: Other Commodities
ALTERNATIVE: Badenergy2003A

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77 90	90 03
Upper Mississippi	Shipped	37	37	38	40	41	42	43	0.5	0.7
	Received	151	151	152	153	155	157	158	0.1	0.2
Lower Upper Mississippi	Shipped	1,139	1,141	1,149	1,158	1,167	1,179	1,187	0.1	0.2
	Received	529	533	543	556	568	584	595	0.4	0.5
Lower Mississippi	Shipped	1,210	1,214	1,224	1,236	1,248	1,263	1,274	0.2	0.2
	Received	3,193	3,196	3,204	3,213	3,223	3,236	3,244	0.0	0.1
Baton Rouge to Gulf	Shipped	1,202	1,274	1,474	1,714	1,951	2,251	2,461	2.8	2.8
	Received	3,804	3,836	3,969	4,143	4,318	4,558	4,731	0.7	1.0
Illinois River	Shipped	22	24	29	36	42	50	56	3.7	3.4
	Received	55	60	73	89	105	124	138	3.7	3.4
Missouri River	Shipped	327	327	328	328	328	329	329	0.0	0.0
	Received	329	330	331	332	333	334	335	0.1	0.1
Ohio River	Shipped	1,880	1,894	1,932	1,978	2,023	2,081	2,121	0.4	0.5
	Received	506	519	554	595	637	689	726	1.3	1.5
Tennessee River	Shipped	1,572	1,576	1,587	1,599	1,611	1,627	1,638	0.1	0.2
	Received	82	88	103	122	141	165	181	3.1	3.1
Arkansas River	Shipped	634	635	636	639	641	644	646	0.1	0.1
	Received	692	693	697	702	706	711	715	0.1	0.1
Gulf Coast West	Shipped	10,391	10,670	11,629	12,833	14,038	15,635	16,777	1.6	2.1
	Received	11,821	12,058	12,948	14,084	15,227	16,765	17,872	1.4	1.8
Gulf Coast East	Shipped	5,648	5,526	5,353	5,204	5,075	4,982	4,945	-0.6	-0.4
	Received	2,608	2,561	2,506	2,466	2,434	2,424	2,430	-0.4	0.1
Warrior River System	Shipped	1,195	1,162	1,111	1,064	1,020	980	958	-0.9	-0.8
	Received	1,426	1,387	1,325	1,268	1,214	1,165	1,137	0.9	-0.8
South Atlantic Coast	Shipped	846	746	918	1,108	1,343	1,629	1,836	4.2	4.0
	Received	413	478	588	709	859	1,042	1,175	4.2	4.0
Middle Atlantic Coast	Shipped	2,830	3,204	3,845	4,555	5,435	6,517	7,299	3.7	3.7
	Received	2,461	2,777	3,319	3,920	4,666	5,584	6,247	3.6	3.7

4/16/80

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Shipped	284	328	403	487	590	716	806	4.2	4.0
	Received	339	392	482	582	704	855	963	4.2	4.0
Great Lakes and Seaway	Shipped	247	255	300	332	363	405	440	2.3	2.2
	Received	254	263	309	342	375	420	457	2.3	2.2
Washington/Oregon Coast	Shipped	763	880	1,083	1,307	1,581	1,918	2,161	4.2	3.9
	Received	249	286	351	424	512	621	699	4.2	3.9
Columbia-Snake Willamette River	Shipped	68	78	93	112	134	160	179	3.9	3.7
	Received	49	54	66	80	94	111	126	3.8	3.5
California Coast	Shipped	1,482	1,709	2,100	2,531	3,063	3,714	4,183	4.2	3.9
	Received	1,051	1,212	1,488	1,793	2,168	2,629	2,961	4.2	3.9
Alaska	Shipped	243	280	345	418	504	612	689	4.2	4.0
	Received	735	849	1,044	1,260	1,527	1,853	2,088	4.2	4.0
Hawaii and Pacific Territories	Shipped	1,025	1,184	1,457	1,758	2,130	2,585	2,913	4.2	4.0
	Received	1,595	1,844	2,268	2,737	3,316	4,024	4,534	4.2	4.0
Domestic Caribbean	Shipped	476	519	608	707	829	980	1,089	3.1	3.4
	Received	979	1,099	1,322	1,569	1,873	2,247	2,517	3.7	3.7
Total	Shipped	33,321	34,663	37,643	41,141	45,156	50,299	54,029	1.6	2.1
	Received	33,321	34,663	37,643	41,141	45,156	50,299	54,029	1.6	2.1

* = less than 500 tons

4/18/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY Other Commodities
ALTERNATIVE Badenergy2003A

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	490	572	799	1,034	1,305	1,695	2,002	5.9	5.2
	Imports	522	550	620	688	734	764	772	2.1	0.9
Illinois River	Exports	23	26	37	48	60	78	92	5.9	5.2
	Imports	57	60	67	74	79	83	85	2.0	1.1
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	788	919	1,283	1,661	2,096	2,723	3,215	5.9	5.2
	Imports	727	765	863	957	1,022	1,064	1,075	2.1	0.9
Gulf Coast East	Exports	24	28	39	51	64	84	99	5.9	5.2
	Imports	91	95	108	119	127	133	134	2.1	0.9
Warrior River System	Exports	45	52	73	94	119	155	183	5.9	5.2
	Imports	47	49	56	62	66	69	69	2.1	0.9
South Atlantic Coast	Exports	1,041	1,214	1,695	2,195	2,769	3,598	4,248	5.9	5.2
	Imports	1,167	1,228	1,382	1,530	1,628	1,684	1,694	2.1	0.8
Middle Atlantic Coast	Exports	3,270	3,816	5,328	6,896	8,701	11,305	13,349	5.9	5.2
	Imports	4,367	4,593	5,171	5,723	6,090	6,299	6,337	2.1	0.8

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4/16/80

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Exports	45	53	74	96	121	157	186	5.9	5.2
	Imports	485	510	574	635	676	699	703	2.1	0.8
Great Lakes and Seaway	Exports	123	144	201	260	328	427	504	5.9	5.2
	Imports	257	269	301	333	356	374	382	2.0	1.1
Washington/Oregon Coast	Exports	100	116	162	210	265	345	407	5.9	5.2
	Imports	1,496	1,740	2,336	3,119	4,069	5,276	6,167	5.8	5.4
Columbia-Snake Willamette River	Exports	25	30	41	54	68	88	104	5.9	5.2
	Imports	408	475	638	851	1,110	1,440	1,683	5.8	5.4
California Coast	Exports	607	708	989	1,280	1,615	2,098	2,477	5.9	5.2
	Imports	3,717	4,324	5,804	7,749	10,109	13,108	15,321	5.8	5.4
Alaska	Exports	20	24	33	43	54	70	83	5.9	5.2
	Imports	137	152	189	234	284	344	386	4.2	3.9
Hawaii and Pacific Territories	Exports	11	13	18	23	29	38	45	5.9	5.2
	Imports	69	76	95	118	143	172	194	4.2	3.9
Domestic Caribbean	Exports	67	79	110	142	179	233	275	5.9	5.2
	Imports	291	323	401	497	603	729	818	4.2	3.9
Total	Exports	6,679	7,794	10,883	14,087	17,773	23,092	27,267	5.9	5.2
	Imports	13,839	15,210	18,604	22,689	27,098	32,238	35,821	3.9	3.6

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL, AND THROUGH

COMMODITY Other Commodities
ALTERNATIVE Badenergy2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	153	154	155	157	160	162	164	0.2	0.3
Lower Upper Mississippi	1,253	1,264	1,295	1,332	1,368	1,415	1,448	0.5	0.6
Lower Mississippi	4,890	4,914	4,980	5,060	5,140	5,241	5,311	0.3	0.4
Baton Rouge to Gulf	4,143	4,194	4,382	4,621	4,860	5,182	5,413	0.8	1.2
Illinois River	83	90	110	134	157	187	207	3.7	3.4
Missouri River	330	331	332	333	335	336	338	0.1	0.1
Ohio River	3,509	3,533	3,599	3,677	3,755	3,854	3,923	0.4	0.5
Tennessee River	1,632	1,641	1,665	1,694	1,723	1,760	1,786	0.3	0.4
Arkansas River	699	701	707	713	720	728	734	0.2	0.2
Gulf Coast West	12,230	12,474	13,383	14,545	15,716	17,294	18,430	1.3	1.8
Gulf Coast East	6,036	5,914	5,746	5,606	5,488	5,412	5,388	-0.6	-0.3
Warrior River System	1,597	1,555	1,491	1,432	1,377	1,329	1,303	-0.8	-0.7
Great Lakes	261	271	319	354	389	437	475	2.4	2.3

* = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY: Other Commodities
ALTERNATIVE: Badenergy2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	14	15	15	15	15	15	16	0.2	0.3
Lower Upper Mississippi	112	113	118	124	129	136	141	0.8	1.0
Lower Mississippi	1,693	1,707	1,745	1,790	1,836	1,893	1,934	0.4	0.6
Baton Rouge to Gulf	393	398	406	420	434	453	467	0.5	0.8
Illinois River	12	13	15	19	22	26	29	3.7	3.4
Missouri River	40	40	41	41	41	42	42	0.1	0.2
Ohio River	231	238	257	281	304	334	355	1.5	1.8
Tennessee River	92	93	97	102	106	112	116	0.8	1.0
Arkansas River	48	48	49	49	50	50	51	0.2	0.2
Gulf Coast West	1,001	999	1,020	1,052	1,087	1,140	1,182	0.4	0.9
Gulf Coast East	269	264	258	253	249	247	247	0.5	-0.2
Warrior River System	34	33	32	31	30	29	29	-0.7	-0.5
Great Lakes	71	73	87	97	107	120	131	2.5	2.4
Total	4,010	4,033	4,140	4,274	4,410	4,599	4,738	0.5	0.8

a * less than 500,000 ton-miles

WATERBORNE DEMAND PROJECTIONS

NWS MACROECONOMIC SCENARIO

LARGERGOVT2003A

4/21/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY All Commodities
ALTERNATIVE. Largergovt2003A

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Shipped	20,619	27,703	36,558	43,609	45,141	49,342	58,028	5.9	2.2
	Received	16,474	18,790	20,680	24,440	26,779	28,727	28,912	3.1	1.3
Lower Upper Mississippi	Shipped	23,149	24,918	28,854	35,394	40,391	43,380	47,147	3.3	2.2
	Received	9,042	9,180	11,084	17,026	21,508	26,146	27,757	5.0	3.8
Lower Mississippi	Shipped	11,136	12,843	13,907	14,073	17,128	13,563	18,176	1.8	2.0
	Received	24,819	24,470	25,359	26,925	28,239	29,756	30,517	0.6	1.0
Baton Rouge to Gulf	Shipped	84,271	85,816	88,637	96,646	99,779	106,036	109,439	1.1	1.0
	Received	99,444	126,507	151,070	180,650	198,932	220,603	255,361	4.7	2.7
Illinois River	Shipped	32,515	34,557	42,856	47,698	47,588	52,457	61,154	3.0	1.9
	Received	31,245	34,794	38,129	41,586	44,677	48,711	50,662	2.2	1.5
Missouri River	Shipped	5,612	6,060	6,318	6,172	6,087	5,915	5,975	0.7	-0.2
	Received	4,635	4,624	4,478	4,113	4,023	4,068	3,917	-0.9	-0.4
Ohio River	Shipped	140,247	145,249	174,119	207,464	236,449	263,177	278,089	3.1	2.3
	Received	134,112	137,759	160,771	174,875	188,549	202,935	210,092	2.1	1.4
Tennessee River	Shipped	10,493	10,673	11,113	12,718	17,772	20,582	22,424	1.5	4.5
	Received	17,457	17,550	18,058	20,867	23,517	26,530	28,299	1.4	2.4
Arkansas River	Shipped	6,638	6,897	7,080	9,146	11,441	12,219	13,412	2.5	3.0
	Received	6,816	6,836	6,741	6,432	6,384	6,543	6,406	-0.4	0.0
Gulf Coast West	Shipped	148,122	148,479	143,933	154,227	160,176	169,082	175,966	0.3	1.0
	Received	75,159	95,011	97,495	109,726	120,148	135,978	147,014	3.0	2.3
Gulf Coast East	Shipped	32,236	32,312	35,846	40,725	46,293	54,149	52,998	1.8	2.0
	Received	38,641	37,885	43,364	51,456	57,549	63,278	65,658	2.2	1.9
Warrior River System	Shipped	23,871	24,905	27,795	34,544	35,447	39,217	43,634	2.9	1.8
	Received	20,413	21,588	23,745	29,442	34,096	39,067	44,591	2.9	3.2
South Atlantic Coast	Shipped	12,464	11,850	11,455	11,526	10,945	11,277	11,771	-0.6	0.2
	Received	37,490	36,673	36,052	36,659	36,339	37,377	38,352	-0.2	0.3
Middle Atlantic Coast	Shipped	159,990	162,264	166,238	168,470	167,361	170,096	172,199	0.4	0.2
	Received	181,200	182,822	176,260	178,998	178,361	181,607	184,188	-0.1	0.2

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SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
North Atlantic Coast	Shipped	9,914	10,345	10,306	9,988	9,408	8,960	8,684	0.1	-1.1
	Received	50,273	50,969	48,271	49,865	49,004	48,356	47,955	-0.1	-0.3
Great Lakes and Seaway	Shipped	109,590	147,110	161,982	170,040	184,220	207,442	220,335	3.4	2.0
	Received	107,660	143,125	157,657	165,252	179,087	201,386	213,644	3.4	2.0
Washington/Oregon Coast	Shipped	22,600	24,357	24,430	25,523	25,692	26,430	26,776	0.9	0.4
	Received	24,992	35,879	55,711	59,639	61,781	59,317	57,204	6.9	-0.3
Columbia-Snake Willamette River	Shipped	22,406	28,810	27,928	29,193	28,450	28,401	27,425	2.1	-0.5
	Received	25,848	31,035	32,341	33,788	32,898	32,608	31,482	2.1	-0.5
California Coast	Shipped	43,257	37,867	41,158	44,888	44,287	43,812	43,977	0.3	-0.2
	Received	50,472	71,517	72,807	72,101	64,793	55,709	49,187	2.8	-2.9
Alaska	Shipped	19,485	89,388	101,745	102,441	102,826	103,340	103,699	13.6	0.1
	Received	6,077	7,070	7,577	8,238	8,659	9,252	9,644	2.4	1.2
Hawaii and Pacific Territories	Shipped	5,412	5,566	6,338	7,059	7,601	8,409	9,030	2.1	1.9
	Received	6,230	7,269	8,207	9,052	9,738	10,749	11,534	2.9	1.9
Domestic Caribbean	Shipped	32,405	33,778	36,065	38,901	40,490	42,120	43,330	1.4	0.8
	Received	7,931	8,191	8,785	9,317	9,914	10,699	11,289	1.2	1.5
Total	Shipped	976,428	1,109,545	1,204,640	1,310,446	1,384,974	1,479,404	1,553,667	2.3	1.3
	Received	976,428	1,109,545	1,204,640	1,310,446	1,384,974	1,479,404	1,553,667	2.3	1.3

* = less than 500 tons

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY All Commodities
ALTERNATIVE Largergovt2003A

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	59,920	73,385	97,499	108,027	112,468	114,601	147,400	4.6	2.4
	Imports	97,255	111,890	124,219	123,190	129,498	139,115	145,774	1.8	1.3
Illinois River	Exports	2,571	4,363	5,780	6,458	6,358	7,065	8,950	7.3	2.5
	Imports	3,573	2,673	3,245	3,489	3,725	4,084	4,303	-0.2	1.6
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	35,406	47,012	55,025	60,866	61,808	64,584	67,314	4.3	0.8
	Imports	137,104	158,267	174,270	171,157	178,715	190,897	199,283	1.7	1.2
Gulf Coast East	Exports	22,089	25,017	29,851	25,391	21,531	18,263	16,991	1.1	-3.0
	Imports	17,812	20,252	22,107	22,217	22,904	24,051	24,865	1.7	0.9
Warrior River System	Exports	5,521	7,178	9,580	10,834	13,635	12,745	16,424	5.3	3.3
	Imports	8,167	8,964	9,760	11,525	13,158	16,137	17,865	2.7	3.4
South Atlantic Coast	Exports	8,618	10,308	12,552	13,140	13,943	14,840	15,980	3.3	1.5
	Imports	20,701	18,853	19,270	19,756	19,112	19,046	19,128	-0.4	-0.2
Middle Atlantic Coast	Exports	56,757	62,186	77,876	87,296	90,836	100,735	113,172	3.4	2.0
	Imports	168,692	159,041	164,683	171,946	173,211	177,048	180,005	0.1	0.4

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Exports	1,307	1,658	2,061	2,134	2,210	2,304	2,372	3.8	0.8
	Imports	33,997	27,453	34,138	39,659	40,598	42,012	43,884	1.2	0.8
Great Lakes and Seaway	Exports	33,765	43,817	55,632	63,178	67,149	72,520	79,524	4.9	1.8
	Imports	29,255	29,069	32,600	34,435	36,969	41,269	43,798	1.3	1.9
Washington/Oregon Coast	Exports	18,060	20,529	23,972	23,602	22,091	24,703	27,001	2.1	1.0
	Imports	20,019	12,597	34,121	39,847	45,391	47,634	48,954	5.4	1.6
Columbia-Snake Willamette River	Exports	12,821	15,526	19,277	20,175	19,018	18,431	16,994	3.5	-1.3
	Imports	4,045	3,769	4,408	4,903	5,632	6,494	7,102	1.5	2.9
California Coast	Exports	15,982	19,769	22,613	24,359	24,766	27,243	29,225	3.3	1.4
	Imports	60,187	26,441	29,634	32,358	34,976	38,928	41,852	-4.7	2.0
Alaska	Exports	5,024	3,331	3,165	3,004	2,944	2,923	2,937	-3.9	-0.2
	Imports	1,619	1,391	1,425	1,476	1,529	1,612	1,659	-0.7	1.0
Hawaii and Pacific Territories	Exports	147	153	177	189	200	218	233	2.0	1.6
	Imports	5,926	4,634	4,609	4,759	4,686	4,673	4,697	-1.7	-0.1
Domestic Caribbean	Exports	1,463	2,168	1,850	1,841	1,931	2,028	2,120	1.8	1.1
	Imports	51,645	39,704	36,338	40,196	31,115	24,102	21,425	-1.9	-4.7
Total	Exports	279,451	336,401	416,910	450,493	460,886	483,202	546,637	3.7	1.5
	Imports	659,998	624,998	694,827	720,714	741,220	777,102	804,601	0.7	0.9

* = less than 500 tons

4/21/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL, AND THROUGH

COMMODITY: All Commodities
ALTERNATIVE Largergovt2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	30,874	39,065	48,301	56,648	59,189	64,745	73,524	4.8	2.0
Lower Upper Mississippi	77,493	89,232	110,831	131,204	140,307	156,970	180,365	4.1	2.5
Lower Mississippi	123,602	137,775	167,343	202,563	230,998	255,063	293,257	3.9	2.9
Baton Rouge to Gulf	187,257	215,479	245,812	289,537	322,148	358,191	400,125	3.4	2.5
Illinois River	54,342	60,403	71,248	78,183	80,722	89,533	100,409	2.8	1.9
Missouri River	6,735	7,245	7,610	7,565	7,557	7,486	7,590	0.9	0.0
Ohio River	172,739	178,645	211,177	248,330	284,422	317,014	335,589	2.8	2.3
Tennessee River	22,056	22,360	23,477	27,190	34,127	39,063	42,257	1.6	3.4
Arkansas River	9,396	9,709	10,154	12,448	14,875	15,888	17,151	2.2	2.5
Gulf Coast West	168,762	188,073	181,983	198,843	211,678	231,684	245,999	1.3	1.7
Gulf Coast East	69,061	68,618	77,235	88,613	102,089	116,000	118,262	1.9	2.2
Warrior River System	30,006	31,112	34,273	41,527	47,273	53,347	59,468	2.5	2.8
Great Lakes	115,807	154,130	169,221	177,199	191,773	215,453	228,599	3.3	2.0

* = less than 500 tons

4/21/80

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON-MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY. All Commodities
ALTERNATIVE Largergovt2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	10,153	12,981	16,125	18,627	19,210	21,200	24,601	4.8	2.2
Lower Upper Mississippi	13,960	16,364	20,550	23,867	24,991	27,869	32,522	4.2	2.4
Lower Mississippi	71,393	80,783	100,480	123,321	140,583	157,483	181,748	4.3	3.0
Baton Rouge to Gulf	20,845	24,527	27,797	32,615	36,489	40,979	45,824	3.5	2.7
Illinois River	8,005	9,009	10,640	11,627	12,032	13,409	15,090	2.9	2.0
Missouri River	1,990	2,271	2,549	2,705	2,766	2,752	2,879	2.4	0.5
Ohio River	41,386	43,409	52,727	65,754	76,971	87,852	93,810	3.6	2.8
Tennessee River	3,602	3,736	4,005	4,574	5,746	6,540	7,103	1.9	3.4
Arkansas River	1,398	1,474	1,635	2,239	2,812	3,052	3,369	3.7	3.2
Gulf Coast West	18,800	19,621	20,308	22,587	24,134	26,209	27,612	1.4	1.6
Gulf Coast East	4,697	4,637	5,097	5,839	7,072	7,912	8,363	1.7	2.8
Warrior River System	4,686	4,987	5,610	7,219	7,528	8,500	9,698	3.4	2.3
Great Lakes	56,759	80,671	88,356	92,587	101,002	114,652	122,377	3.8	2.2
Total	257,673	304,467	355,878	413,561	481,336	518,410	574,995	3.7	2.6

* = less than 500,000 ton-miles

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY Farm Products
ALTERNATIVE Largergov12003A

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77 90	90 03
Upper Mississippi	Shipped	11,547	16,956	23,688	26,743	25,938	29,036	37,138	6.7	2.6
	Received	43	44	44	45	45	46	46	0.3	0.3
Lower Upper Mississippi	Shipped	3,046	3,706	4,661	4,893	5,443	4,724	6,561	3.7	2.3
	Received	279	292	291	313	319	334	343	0.9	0.7
Lower Mississippi	Shipped	4,370	5,616	6,126	5,706	8,371	4,721	9,114	2.1	3.7
	Received	694	698	698	706	708	714	717	0.1	0.1
Baton Rouge to Gulf	Shipped	837	841	844	851	856	865	870	0.1	0.2
	Received	37,781	47,869	65,294	72,015	74,021	76,032	102,750	5.1	2.8
Illinois River	Shipped	14,941	16,402	23,373	26,574	25,330	29,425	37,767	4.5	2.7
	Received	154	155	155	155	155	156	156	0.0	0.0
Missouri River	Shipped	1,223	1,582	1,966	2,128	2,120	2,027	2,207	4.4	0.3
	Received	6	6	6	6	6	6	6	0.0	0.0
Ohio River	Shipped	4,292	5,157	6,959	7,615	7,930	8,029	11,019	4.5	2.9
	Received	197	202	201	208	211	216	218	0.4	0.4
Tennessee River	Shipped	218	157	177	177	208	174	254	-1.6	2.8
	Received	1,462	1,474	1,474	1,494	1,500	1,514	1,522	0.2	0.1
Arkansas River	Shipped	1,034	1,209	1,261	1,139	1,656	905	1,716	0.7	3.2
	Received	7	7	7	7	7	7	7	0.0	0.0
Gulf Coast West	Shipped	552	604	613	701	740	815	860	1.9	1.6
	Received	271	314	313	385	406	458	487	2.7	1.8
Gulf Coast East	Shipped	208	219	223	242	253	272	283	1.2	1.2
	Received	740	744	749	756	765	775	783	0.2	0.3
Warrior River System	Shipped	730	1,434	1,529	1,345	2,210	1,118	2,536	4.8	5.0
	Received	975	1,677	1,768	1,581	2,440	1,341	2,755	3.8	4.4
South Atlantic Coast	Shipped	107	111	116	122	130	140	147	1.0	1.4
	Received	9	11	12	14	17	20	22	3.3	3.6
Middle Atlantic Coast	Shipped	574	607	652	710	781	872	937	1.6	2.2
	Received	484	512	551	599	661	738	794	1.7	2.2

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4/16/80

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Shipped	6	7	8	9	11	13	15	3.3	3.6
	Received	2	2	3	3	4	5	5	3.3	3.6
Great Lakes and Seaway	Shipped	1,475	1,530	1,530	1,530	1,530	1,530	1,530	0.3	0.0
	Received	1,475	1,530	1,530	1,530	1,530	1,530	1,530	0.3	0.0
Washington/Oregon Coast	Shipped	65	72	81	92	107	125	139	2.8	3.2
	Received	2	3	3	4	4	5	6	3.3	3.3
Columbia-Snake Willamette River	Shipped	3,460	5,257	7,222	8,175	7,599	7,227	6,379	6.8	-1.9
	Received	3,425	5,221	7,184	8,135	7,557	7,181	6,332	6.9	-1.9
California Coast	Shipped	264	295	339	393	461	547	610	3.1	3.4
	Received	73	80	89	100	114	131	144	2.4	2.9
Alaska	Shipped	1	1	1	1	1	1	1	3.3	3.6
	Received	40	45	52	60	71	85	95	3.2	3.5
Hawaii and Pacific Territories	Shipped	389	438	506	591	698	833	931	3.3	3.6
	Received	520	582	667	774	908	1,078	1,201	3.1	3.4
Domestic Caribbean	Shipped	77	79	83	88	93	101	106	1.0	1.5
	Received	776	814	868	935	1,019	1,126	1,203	1.4	2.0
Total	Shipped	49,416	62,281	81,956	89,824	92,467	93,498	121,120	4.7	2.3
	Received	49,416	62,281	81,956	89,824	92,467	93,498	121,120	4.7	2.3

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY Farm Products
ALTERNATIVE Largergovt2003A

SEGMENT	EXP/IMP	1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	43,064	52,630	72,287	79,765	82,348	84,751	115,476	4.9	2.9
	Imports	236	246	250	255	260	264	267	0.6	0.4
Illinois River	Exports	1,353	3,064	4,452	5,075	4,935	5,636	7,455	10.7	3.0
	Imports	3	3	3	3	3	3	3	0.6	0.4
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	20,738	28,537	38,032	44,249	44,972	47,499	49,785	6.0	0.9
	Imports	313	327	332	339	345	351	355	0.6	0.4
Gulf Coast East	Exports	2,751	2,570	3,552	4,233	4,315	5,142	6,140	3.4	2.9
	Imports	709	739	751	766	782	795	803	0.6	0.4
Warrior River System	Exports	1,317	2,886	3,202	2,989	4,688	2,647	5,557	6.4	4.9
	Imports	67	70	71	72	74	75	76	0.6	0.4
South Atlantic Coast	Exports	691	982	1,242	1,423	1,627	1,720	2,189	5.7	3.4
	Imports	441	460	467	477	486	494	499	0.6	0.4
Middle Atlantic Coast	Exports	13,055	16,113	23,555	27,160	26,002	30,241	38,493	5.8	2.7
	Imports	1,944	2,027	2,058	2,102	2,143	2,179	2,202	0.6	0.4

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SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Exports	76	86	104	129	152	178	195	4.1	3.2
	Imports	22	23	23	23	24	24	25	0.6	0.4
Great Lakes and Seaway	Exports	9,610	13,553	18,573	21,153	21,320	22,526	26,744	6.3	1.8
	Imports	135	139	141	143	145	147	148	0.4	0.3
Washington/Oregon Coast	Exports	1,626	5,429	8,395	10,053	8,940	11,521	13,628	15.0	2.4
	Imports	16	16	17	17	17	18	18	0.6	0.4
Columbia-Snake Willamette River	Exports	6,521	9,777	13,401	15,227	14,335	13,811	12,391	6.7	-1.6
	Imports	5	5	6	6	6	6	6	0.6	0.4
California Coast	Exports	3,236	5,780	7,953	9,606	9,685	11,632	13,019	8.7	2.4
	Imports	575	600	609	622	634	645	651	0.6	0.4
Alaska	Exports	a	a	a	a	a	a	a	4.1	3.2
	Imports	6	6	6	6	6	6	6	0.1	0.1
Hawaii and Pacific Territories	Exports	3	3	4	4	5	6	7	4.1	3.2
	Imports	2	2	2	2	3	3	3	0.6	0.4
Domestic Caribbean	Exports	17	19	23	29	34	39	43	4.0	3.2
	Imports	129	132	133	134	135	136	137	0.3	0.2
Total	Exports	104,059	141,429	194,775	221,074	223,358	237,349	291,123	6.0	2.1
	Imports	4,603	4,796	4,867	4,968	5,064	5,146	5,199	0.6	0.4

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL, AND THROUGH

COMMODITY Farm Products
ALTERNATIVE Largergovt2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	11,558	16,967	23,699	26,754	25,949	29,047	37,149	6.7	2.6
Lower Upper Mississippi	30,632	38,520	53,562	60,211	58,703	65,083	83,544	5.3	2.6
Lower Mississippi	38,711	48,795	66,222	72,936	74,942	76,950	103,667	5.0	2.7
Baton Rouge to Gulf	39,145	49,253	66,681	73,435	75,456	77,496	104,231	5.0	2.7
Illinois River	14,982	16,443	23,414	26,615	25,371	29,466	37,808	4.5	2.7
Missouri River	1,229	1,588	1,972	2,135	2,126	2,033	2,213	4.3	0.3
Ohio River	5,965	6,785	8,606	9,287	9,641	9,725	12,805	3.5	2.5
Tennessee River	1,663	1,614	1,633	1,653	1,690	1,669	1,757	0.0	0.5
Arkansas River	1,040	1,216	1,268	1,146	1,662	911	1,723	0.7	3.2
Gulf Coast West	697	767	775	892	939	1,035	1,092	1.9	1.6
Gulf Coast East	1,285	1,303	1,312	1,341	1,361	1,392	1,413	0.3	0.4
Warrior River System	1,162	1,868	1,963	1,781	2,647	1,556	2,975	3.3	4.0
Great Lakes	1,475	1,530	1,530	1,530	1,530	1,530	1,530	0.3	0.0

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY Farm Products
ALTERNATIVE Largergovt2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	4,569	6,711	9,376	10,586	10,267	11,493	14,701	6.7	2.6
Lower Upper Mississippi	6,456	8,134	11,359	12,791	12,433	13,860	17,788	5.4	2.6
Lower Mississippi	25,576	32,248	44,347	49,237	49,757	52,378	69,643	5.2	2.7
Baton Rouge to Gulf	4,993	6,254	8,477	9,352	9,554	9,873	13,172	4.9	2.7
Illinois River	2,601	2,856	4,072	4,631	4,414	5,129	6,585	4.5	2.7
Missouri River	590	762	946	1,024	1,020	975	1,062	4.3	0.3
Ohio River	1,422	1,664	2,242	2,470	2,524	2,626	3,514	4.3	2.7
Tennessee River	596	597	597	604	612	610	623	0.1	0.2
Arkansas River	237	277	289	261	378	207	392	0.7	3.2
Gulf Coast West	115	125	125	141	146	159	165	1.6	1.2
Gulf Coast East	96	98	98	102	103	106	108	0.5	0.5
Warrior River System	84	169	180	157	262	128	299	4.9	5.1
Great Lakes	1,217	1,255	1,255	1,255	1,255	1,255	1,255	0.2	0.0
Total	48,551	61,148	83,363	92,609	92,725	98,798	129,308	5.1	2.6

a = less than 500,000 ton-miles

4/21/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY. Metallic Ores
ALTERNATIVE Largergovt2003A

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Shipped	13	14	15	16	17	18	19	1.5	1.2
	Received	18	19	21	22	23	25	26	1.5	1.2
Lower Upper Mississippi	Shipped	31	33	36	38	40	42	44	1.5	1.2
	Received	43	45	49	51	53	56	58	1.3	1.0
Lower Mississippi	Shipped	1	2	2	2	2	2	2	1.5	1.2
	Received	92	97	107	112	117	125	130	1.5	1.2
Baton Rouge to Gulf	Shipped	2,377	2,483	2,717	2,847	2,998	3,287	3,470	1.4	1.5
	Received	95	100	109	115	120	128	133	1.5	1.1
Illinois River	Shipped	69	69	70	71	71	72	72	0.2	0.2
	Received	4,470	7,439	8,077	8,521	9,293	10,650	11,499	5.1	2.3
Missouri River	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Shipped	248	260	285	299	312	332	345	1.5	1.1
	Received	1,108	1,150	1,259	1,316	1,402	1,586	1,700	1.3	2.0
Tennessee River	Shipped	16	17	19	20	21	22	23	1.5	1.2
	Received	465	489	537	564	589	629	655	1.5	1.2
Arkansas River	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	755	795	872	917	957	1,022	1,064	1.5	1.2
Gulf Coast West	Shipped	78	82	90	95	99	106	110	1.5	1.2
	Received	105	110	119	124	129	137	142	1.3	1.0
Gulf Coast East	Shipped	121	128	140	147	154	164	171	1.5	1.2
	Received	62	65	72	75	79	84	87	1.5	1.2
Warrior River System	Shipped	3,693	3,737	4,019	5,141	6,305	8,416	9,649	2.6	5.0
	Received	3,716	3,760	4,041	5,162	6,326	8,437	9,669	2.6	4.9
South Atlantic Coast	Shipped	434	446	479	616	758	1,016	1,166	2.7	5.0
	Received	501	514	547	683	825	1,083	1,233	2.4	4.6
Middle Atlantic Coast	Shipped	71	71	71	71	71	71	71	0.0	0.0
	Received	3	3	3	3	3	3	3	0.0	0.0

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SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	0	0	0	0	0	0	0	0.0	0.0
Great Lakes and Seaway	Shipped	45,198	71,265	78,195	83,182	91,145	104,698	112,706	4.8	2.4
	Received	40,917	64,022	70,326	74,877	82,075	94,282	101,450	4.8	2.4
Washington/Oregon Coast	Shipped	a	a	a	a	a	a	a	0.0	0.0
	Received	4	4	4	4	4	4	4	0.0	0.0
Columbia-Snake Willamette River	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	0	0	0	0	0	0	0	0.0	0.0
California Coast	Shipped	4	4	4	4	4	4	4	0.0	0.0
	Received	a	a	a	a	a	a	a	0.0	0.0
Alaska	Shipped	4	4	4	4	4	4	4	0.0	0.0
	Received	a	a	a	a	a	a	a	0.0	0.0
Hawaii and Pacific Territories	Shipped	a	a	a	a	a	a	a	0.0	0.0
	Received	4	4	4	4	4	4	4	0.0	0.0
Domestic Caribbean	Shipped	a	a	a	a	a	a	a	0.0	0.0
	Received	a	a	a	a	a	a	a	0.0	0.0
Total	Shipped	52,361	78,616	86,147	92,553	102,000	118,255	127,857	4.5	2.5
	Received	52,361	78,616	86,147	92,553	102,000	118,255	127,857	4.5	2.5

a = less than 500 tons

4/21/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY Metallic Ores
ALTERNATIVE Largergovt2003A

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77 90	90 03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	97	102	111	121	132	143	150	1.7	1.7
	Imports	8,049	8,391	9,444	10,179	10,965	12,066	12,820	1.8	1.8
Illinois River	Exports	*	*	*	*	1	1	1	1.7	1.7
	Imports	1,239	993	1,082	1,144	1,248	1,427	1,539	-0.6	2.3
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	9	9	10	11	12	13	13	1.7	1.6
	Imports	8,047	8,370	9,400	10,408	11,440	12,955	13,943	2.0	2.3
Gulf Coast East	Exports	112	118	128	139	151	164	173	1.7	1.7
	Imports	204	213	240	260	280	307	325	1.9	1.7
Warrior Riv System	Exports	1	1	1	2	2	2	2	1.7	1.7
	Imports	6,683	6,838	7,483	9,069	10,711	13,572	15,276	2.4	4.1
South Atlantic Coast	Exports	38	40	43	47	51	55	58	1.7	1.7
	Imports	1,144	1,177	1,299	1,528	1,764	2,163	2,404	2.3	3.5
Middle Atlantic Coast	Exports	170	129	140	153	166	180	189	-0.8	1.7
	Imports	14,439	11,115	12,912	13,636	15,247	17,360	18,344	0.4	2.3

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SEGMENT	EXP/IMP	YEARS 1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Exports	1	1	1	1	1	1	1	1.7	1.7
	Imports	13	13	15	16	18	19	21	1.9	1.7
Great Lakes and Seaway	Exports	2,396	3,584	3,597	3,611	3,627	3,644	3,655	3.2	0.1
	Imports	18,073	17,300	19,109	20,351	22,324	25,787	27,791	0.9	2.4
Washington/Oregon Coast	Exports	1	1	1	1	1	1	1	1.7	1.7
	Imports	114	119	135	146	157	172	182	1.9	1.7
Columbia-Snake Willamette River	Exports	a	a	a	a	a	a	a	1.7	1.7
	Imports	85	126	147	158	171	195	208	4.9	2.1
California Coast	Exports	58	62	67	73	79	85	89	1.7	1.6
	Imports	349	626	743	797	861	998	1,067	6.6	2.3
Alaska	Exports	460	484	526	572	621	675	710	1.7	1.7
	Imports	a	a	a	a	a	a	a	0.0	0.0
Hawaii and Pacific Territories	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Domestic Caribbean	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	1,147	1,198	1,354	1,465	1,579	1,728	1,829	1.9	1.7
Total	Exports	3,343	4,531	4,627	4,730	4,843	4,965	5,043	2.7	0.5
	Imports	59,586	56,479	63,365	69,159	76,786	88,748	95,750	1.2	2.5

a = less than 500 tons

4/21/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL, AND THROUGH

COMMODITY: Metallic Ores
ALTERNATIVE: Largergovt2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	31	33	36	38	40	43	44	1.5	1.2
Lower Upper Mississippi	252	265	290	305	318	339	353	1.5	1.1
Lower Mississippi	2,510	2,625	2,878	3,018	3,179	3,483	3,676	1.4	1.5
Baton Rouge to Gulf	2,665	2,786	3,050	3,197	3,363	3,677	3,876	1.4	1.5
Illinois River	4,584	7,559	8,210	8,660	9,439	10,805	11,660	5.0	2.3
Missouri River	0	0	0	0	0	0	0	0.0	0.0
Ohio River	1,641	1,710	1,873	1,961	2,074	2,304	2,447	1.4	1.7
Tennessee River	471	496	544	572	597	638	664	1.5	1.2
Arkansas River	755	795	872	917	957	1,022	1,064	1.5	1.2
Gulf Coast West	181	190	207	216	225	239	249	1.4	1.1
Gulf Coast East	254	265	288	301	313	332	345	1.3	1.0
Warrior River System	3,742	3,787	4,070	5,193	6,358	8,472	9,705	2.6	4.9
Great Lakes	45,299	71,371	78,311	83,304	91,273	104,834	112,849	4.8	2.4

a = less than 500 tons

4/21/80

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY Metallic Ores
ALTERNATIVE Largergovt2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	11	11	12	13	14	14	15	1.5	1.2
Lower Upper Mississippi	53	55	61	64	66	71	74	1.5	1.1
Lower Mississippi	1,469	1,534	1,682	1,763	1,860	2,048	2,167	1.4	1.6
Baton Rouge to Gulf	288	301	329	345	363	396	418	1.4	1.5
Illinois River	145	222	241	254	276	313	336	4.4	2.2
Missouri River	0	0	0	0	0	0	0	0.0	0.0
Ohio River	1,003	1,045	1,152	1,205	1,276	1,434	1,532	1.4	1.9
Tennessee River	56	59	65	69	72	76	80	1.5	1.2
Arkansas River	90	95	104	109	114	122	127	1.5	1.2
Gulf Coast West	37	38	42	44	46	49	51	1.5	1.1
Gulf Coast East	12	12	13	13	14	14	15	1.0	0.8
Warrior River System	1,354	1,370	1,473	1,885	2,313	3,090	3,543	2.6	5.0
Great Lakes	33,507	52,553	57,743	61,437	67,359	77,422	83,330	4.8	2.4
Total	38,023	57,295	62,916	67,201	73,771	85,050	91,686	4.5	2.4

* = less than 500,000 ton-miles

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY Coal
ALTERNATIVE Largergovt2003A

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77 90	90 03
Upper Mississippi	Shipped	2,314	3,504	5,170	8,941	11,059	12,158	12,557	11.0	2.6
	Received	6,840	8,399	10,432	13,962	15,665	16,101	16,432	5.6	1.3
Lower Upper Mississippi	Shipped	7,446	7,821	10,111	15,754	19,655	23,083	24,433	5.9	3.4
	Received	2,018	2,051	3,756	9,584	13,770	17,908	19,323	12.7	5.5
Lower Mississippi	Shipped	5	5	6	7	7	8	8	3.4	1.0
	Received	4,244	3,958	4,296	5,309	6,204	7,043	7,475	1.7	2.7
Baton Rouge to Gulf	Shipped	2,911	2,789	3,347	4,076	3,353	3,475	3,520	2.6	-1.1
	Received	3,445	4,617	7,455	20,922	30,914	39,736	43,266	14.9	5.7
Illinois River	Shipped	7,457	7,066	9,405	11,206	12,278	12,948	13,230	3.2	1.3
	Received	6,138	6,405	8,391	11,051	12,364	13,089	13,372	4.6	1.5
Missouri River	Shipped	1	2	2	3	3	3	3	4.6	1.5
	Received	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Shipped	98,828	103,122	131,024	165,594	193,794	218,264	230,252	4.1	2.6
	Received	83,043	86,602	108,832	122,982	134,614	144,696	150,717	3.1	1.6
Tennessee River	Shipped	4,079	4,171	4,533	6,215	11,076	13,789	15,530	3.3	7.3
	Received	7,435	7,396	7,290	9,681	11,698	13,822	15,112	2.1	3.5
Arkansas River	Shipped	515	649	1,139	3,821	5,789	7,451	8,018	16.7	5.9
	Received	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Shipped	a	a	a	a	a	a	a	10.0	5.0
	Received	261	322	797	4,591	7,427	9,795	10,519	24.7	6.6
Gulf Coast East	Shipped	692	1,030	2,304	5,016	8,470	10,608	11,384	16.5	6.5
	Received	8,063	7,563	12,629	20,353	26,475	31,538	33,376	7.4	3.9
Warrior River System	Shipped	7,821	8,064	10,474	15,960	14,628	16,966	18,473	5.6	1.1
	Received	7,118	7,547	9,290	14,019	16,484	20,046	22,729	5.4	3.8
South Atlantic Coast	Shipped	a	a	a	a	a	a	a	2.5	2.3
	Received	2	2	2	2	2	2	2	0.0	0.0
Middle Atlantic Coast	Shipped	5,034	8,320	15,913	20,090	25,507	31,322	35,278	11.2	4.4
	Received	5,026	8,312	14,405	17,083	22,500	28,315	32,270	9.9	5.0

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	a	a	1,500	3,000	3,000	3,000	3,000	155.7	0.0
Great Lakes and Seaway	Shipped	19,145	24,961	25,578	24,025	26,748	29,730	31,271	1.8	2.0
	Received	22,615	29,229	29,927	28,170	31,250	34,624	36,368	1.7	2.0
Washington/Oregon Coast	Shipped	37	37	37	37	37	37	37	0.0	0.0
	Received	1	1	1	1	1	1	1	0.0	0.0
Columbia Snake Willamette River	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	0	0	0	0	0	0	0	0.0	0.0
California Coast	Shipped	a	a	a	a	a	a	a	0.0	0.0
	Received	1	1	1	1	1	1	1	0.0	0.0
Alaska	Shipped	11	11	11	11	11	11	11	0.0	0.0
	Received	46	46	46	46	46	46	46	0.0	0.0
Hawaii and Pacific Territories	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	a	a	a	a	a	a	a	0.0	0.0
Domestic Caribbean	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	a	a	a	a	a	a	a	0.0	0.0
Total	Shipped	156,296	172,451	219,049	280,756	332,415	379,854	404,011	4.6	2.8
	Received	156,296	172,451	219,049	280,756	332,415	379,854	404,011	4.6	2.8

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY Coal
ALTERNATIVE Largergovt2003A

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	1,313	1,260	3,760	5,537	6,809	8,202	9,101	11.7	3.9
	Imports	142	252	260	284	277	287	287	5.5	0.1
Illinois River	Exports	12	16	20	23	26	28	30	5.3	1.8
	Imports	0	0	0	0	0	0	0	0.0	0.0
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	18	18	18	18	18	18	18	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast East	Exports	125	125	125	125	125	125	125	0.0	0.0
	Imports	219	385	398	434	425	439	439	5.4	0.1
Warrior River System	Exports	3,612	3,569	5,540	6,940	7,943	9,040	9,748	5.2	2.6
	Imports	866	1,526	1,580	1,721	1,684	1,741	1,741	5.4	0.1
South Atlantic Coast	Exports	1	1	1	1	1	1	1	0.0	0.0
	Imports	*	1	1	1	1	1	1	5.4	0.1
Middle Atlantic Coast	Exports	31,986	31,867	37,397	41,328	44,143	47,224	49,211	2.0	1.4
	Imports	308	536	555	605	592	612	612	5.4	0.1

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
North Atlantic Coast	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Great Lakes and Seaway	Exports	16,868	21,161	26,906	30,988	33,912	37,113	39,176	4.8	1.8
	Imports	19	33	35	38	37	38	38	5.4	0.1
Washington/Oregon Coast	Exports	a	a	a	a	a	a	a	0.0	0.0
	Imports	13	21	22	24	23	24	24	4.9	0.1
Columbia-Snake Willamette River	Exports	a	a	a	a	a	a	a	0.0	0.0
	Imports	a	a	a	a	a	a	a	5.0	0.1
California Coast	Exports	1	1	1	1	1	1	1	0.0	0.0
	Imports	157	276	285	311	304	315	315	5.4	0.1
Alaska	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Hawaii and Pacific Territories	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Domestic Caribbean	Exports	a	a	a	a	a	a	a	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Total	Exports	53,938	58,020	73,770	84,962	92,980	101,755	107,412	3.6	1.8
	Imports	1,722	3,030	3,137	3,416	3,343	3,457	3,457	5.4	0.1

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL, AND THROUGH

COMMODITY: Coal
ALTERNATIVE: Largergovt2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	6,872	8,451	10,626	15,279	17,823	19,053	19,513	6.3	1.9
Lower Upper Mississippi	10,683	11,752	15,599	26,208	33,882	40,777	42,348	7.1	3.9
Lower Mississippi	11,938	12,407	18,709	40,636	61,623	77,737	84,827	9.9	5.8
Baton Rouge to Gulf	10,410	11,006	17,451	38,973	58,271	73,617	80,112	10.7	5.7
Illinois River	9,625	10,695	12,766	15,224	16,898	18,018	18,504	3.6	1.5
Missouri River	1	2	2	3	3	3	3	4.6	1.5
Ohio River	100,229	104,641	133,307	168,762	201,132	222,573	240,849	4.1	2.8
Tennessee River	8,457	8,513	8,813	11,899	17,944	21,904	24,403	2.7	5.7
Arkansas River	515	649	1,139	3,821	5,789	7,451	8,018	16.7	5.9
Gulf Coast West	261	322	797	4,591	7,427	9,795	10,519	24.7	6.6
Gulf Coast East	8,446	7,975	13,132	21,095	31,806	38,748	42,001	7.3	5.4
Warrior River System	8,178	8,443	10,941	16,665	19,920	24,135	27,055	5.6	3.8
Great Lakes	22,615	29,229	29,927	28,170	31,250	34,624	36,368	1.7	2.0

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON-MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY Coal
ALTERNATIVE Largergovt2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77 90	90 03
Upper Mississippi	2,213	2,489	2,899	3,999	4,662	5,063	5,201	4.7	2.0
Lower Upper Mississippi	1,351	1,540	1,993	3,241	4,162	4,970	5,269	7.0	3.8
Lower Mississippi	5,623	6,077	10,103	23,849	37,268	47,418	51,777	11.8	6.1
Baton Rouge to Gulf	1,459	1,596	2,458	4,718	6,997	8,746	9,594	9.4	5.6
Illinois River	1,260	1,482	1,795	2,143	2,419	2,615	2,703	4.2	1.8
Missouri River	*	*	*	*	*	*	*	4.6	1.5
Ohio River	20,152	21,521	29,171	40,676	50,193	58,189	61,886	5.6	3.3
Tennessee River	845	883	911	1,215	2,076	2,581	2,911	2.8	6.9
Arkansas River	189	238	419	1,405	2,128	2,739	2,948	16.7	5.9
Gulf Coast West	76	86	165	791	1,260	1,651	1,771	19.7	6.4
Gulf Coast East	449	410	748	1,259	2,312	2,894	3,203	8.2	7.4
Warrior River System	2,134	2,244	2,806	4,247	4,043	4,750	5,261	5.4	1.7
Great Lakes	8,206	11,393	11,725	10,891	12,353	13,954	14,782	2.2	2.4
Total	43,959	49,960	65,192	98,435	129,873	155,571	167,306	6.4	4.2

* = less than 500,000 ton-miles

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY: Crude Petroleum
ALTERNATIVE: Largergovt2003A

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77 90	90 03
Upper Mississippi	Shipped	1	1	1	1	2	2	2	0.7	1.3
	Received	597	1,180	586	612	628	644	656	0.2	0.5
Lower Upper Mississippi	Shipped	14	14	14	15	16	17	17	0.6	1.2
	Received	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Shipped	36	36	36	38	39	40	41	0.3	0.6
	Received	2,750	2,711	2,716	2,857	2,922	2,992	3,044	0.3	0.5
Baton Rouge to Gulf	Shipped	11,066	11,413	11,084	11,857	12,384	13,056	13,585	0.5	1.1
	Received	12,168	25,321	23,041	24,605	27,333	33,281	37,893	5.6	3.4
Illinois River	Shipped	95	94	94	98	101	104	107	0.2	0.7
	Received	65	64	64	67	69	71	73	0.2	0.7
Missouri River	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Shipped	38	74	37	39	40	41	41	0.2	0.5
	Received	357	354	353	370	379	390	397	0.3	0.6
Tennessee River	Shipped	3	6	3	3	3	3	4	0.2	0.5
	Received	9	8	8	9	9	9	10	0.3	0.5
Arkansas River	Shipped	4	4	4	4	4	5	5	0.3	0.4
	Received	21	20	21	22	22	23	23	0.3	0.4
Gulf Coast West	Shipped	22,737	21,600	21,129	22,698	23,754	25,106	26,177	0.0	1.1
	Received	20,527	38,736	35,623	37,993	41,796	50,014	56,383	4.8	3.1
Gulf Coast East	Shipped	1,028	883	762	822	865	923	969	-1.7	1.3
	Received	347	202	59	63	67	71	75	-12.3	1.3
Warrior River System	Shipped	3,807	3,802	3,779	4,060	4,264	4,529	4,738	0.5	1.2
	Received	768	759	775	836	881	940	987	0.7	1.3
South Atlantic Coast	Shipped	666	658	668	709	737	773	801	0.5	0.9
	Received	0	0	0	0	0	0	0	0.0	0.0
Middle Atlantic Coast	Shipped	13,967	13,687	13,847	14,701	15,038	15,381	15,648	0.4	0.5
	Received	15,937	14,713	13,987	14,846	15,184	15,526	15,794	0.5	0.5

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	0	0	0	0	0	0	0	0.0	0.0
Great Lakes and Seaway	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	0	0	0	0	0	0	0	0.0	0.0
Washington/Oregon Coast	Shipped	526	517	512	534	545	557	567	0.1	0.5
	Received	4,767	13,704	33,899	38,998	39,268	36,415	34,213	17.1	-0.6
Columbia-Snake Willamette River	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	253	1,279	1,216	1,105	920	685	504	12.0	-5.9
California Coast	Shipped	12,618	12,127	11,913	12,333	12,390	12,554	12,730	-0.2	0.2
	Received	22,209	48,279	45,967	42,097	35,483	27,077	20,639	5.0	-5.3
Alaska	Shipped	14,897	84,395	96,418	96,589	96,829	97,131	97,360	15.5	0.1
	Received	645	912	916	955	983	1,015	1,035	3.1	0.6
Hawaii and Pacific Territories	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	17	1,000	1,000	1,000	1,000	1,000	1,000	37.1	0.0
Domestic Caribbean	Shipped	54	54	54	54	54	54	54	0.0	0.0
	Received	122	122	122	122	122	122	122	0.0	0.0
Total	Shipped	81,557	149,367	160,353	164,556	167,065	170,274	172,846	5.5	0.4
	Received	81,557	149,367	160,353	164,556	167,065	170,274	172,846	5.5	0.4

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY Crude Petroleum
ALTERNATIVE Largergovt2003A

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	78,668	92,512	101,352	97,874	101,551	107,652	111,910	1.7	1.0
Illinois River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	53	49	42	36	31	26	25	-3.0	-2.8
	Imports	118,939	139,870	153,236	147,976	153,537	162,761	169,198	1.7	1.0
Gulf Coast East	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	9,270	10,587	11,674	11,185	11,498	12,027	12,377	1.5	0.8
Warrior River System	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	42	50	55	53	55	58	60	1.7	1.0
South Atlantic Coast	Exports	a	a	a	a	a	a	a	-3.0	-2.8
	Imports	1,300	612	777	626	499	302	139	-5.5	-10.9
Middle Atlantic Coast	Exports	200	183	157	135	116	99	94	-3.0	-2.8
	Imports	80,458	78,444	80,003	83,716	84,893	85,877	86,637	0.3	0.3

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SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	12,910	8,421	15,261	20,297	22,304	24,308	26,312	3.5	2.0
Great Lakes and Seaway	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	38	37	37	38	40	41	42	0.2	0.7
Washington/Oregon Coast	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	10,801	2,803	22,921	27,232	31,543	31,543	31,543	7.4	1.1
Columbia-Snake Willamette River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	317	82	82	82	82	82	82	-9.9	0.0
California Coast	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	46,790	12,141	12,141	12,141	12,141	12,141	12,141	-9.9	0.0
Alaska	Exports	1,711	0	0	0	0	0	0	-100.0	0.0
	Imports	303	0	0	0	0	0	0	-100.0	0.0
Hawaii and Pacific Territories	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	2,480	1,388	1,398	1,499	1,574	1,656	1,709	-3.8	1.0
Domestic Caribbean	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	42,834	31,059	27,235	30,578	21,501	14,220	11,296	-2.6	-7.4
Total	Exports	1,964	232	199	171	147	126	118	-17.1	-2.8
	Imports	405,151	378,006	426,172	433,298	441,218	452,669	463,446	0.5	0.5

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL, AND THROUGH

COMMODITY: Crude Petroleum
ALTERNATIVE: Largergovt2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	598	1,182	587	613	629	646	658	0.2	0.5
Lower Upper Mississippi	752	1,334	739	772	793	816	832	0.2	0.6
Lower Mississippi	3,688	4,189	3,640	3,824	3,915	4,012	4,084	0.3	0.5
Baton Rouge to Gulf	18,415	32,033	29,250	31,193	34,151	40,375	45,201	4.1	2.9
Illinois River	150	148	148	154	159	164	168	0.2	0.7
Missouri River	0	0	0	0	0	0	0	0.0	0.0
Ohio River	406	443	401	420	431	443	452	0.3	0.6
Tennessee River	12	15	12	12	12	13	13	0.3	0.5
Arkansas River	21	20	21	22	22	23	23	0.3	0.4
Gulf Coast West	26,705	44,003	40,117	42,837	46,899	55,460	62,100	3.7	2.9
Gulf Coast East	4,857	4,726	4,602	4,947	5,198	5,525	5,784	0.1	1.2
Warrior River System	4,505	4,492	4,484	4,820	5,064	5,383	5,635	0.5	1.2
Great Lakes	0	0	0	0	0	0	0	0.0	0.0

* = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON-MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY Crude Petroleum
ALTERNATIVE Largergovt2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	365	722	359	375	384	394	402	0.2	0.5
Lower Upper Mississippi	164	290	161	168	173	177	181	0.2	0.6
Lower Mississippi	1,790	2,153	1,767	1,853	1,899	1,948	1,984	0.3	0.5
Baton Rouge to Gulf	1,461	3,288	2,910	3,094	3,434	4,197	4,788	5.9	3.4
Illinois River	45	45	44	46	48	49	51	0.2	0.7
Missouri River	0	0	0	0	0	0	0	0.0	0.0
Ohio River	151	158	149	156	160	164	168	0.2	0.6
Tennessee River	5	6	4	5	5	5	5	0.3	0.5
Arkansas River	3	3	3	3	3	3	3	0.3	0.4
Gulf Coast West	2,749	3,201	3,146	3,370	3,577	3,931	4,208	1.6	1.7
Gulf Coast East	532	504	472	507	532	565	591	-0.4	1.2
Warrior River System	231	231	230	248	260	277	290	0.5	1.2
Great Lakes	0	0	0	0	0	0	0	0.0	0.0
Total	7,495	10,601	9,245	9,824	10,476	11,712	12,671	2.1	2.0

a = less than 500,000 ton-miles

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY Nonmetallic Minerals
ALTERNATIVE Largergovt2003A

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Shipped	1,970	1,918	1,736	1,434	1,322	1,274	1,142	-2.4	-1.7
	Received	2,997	2,853	2,546	2,127	1,965	1,975	1,883	-2.6	-0.9
Lower Upper Mississippi	Shipped	1,136	1,104	1,000	833	769	740	668	-2.4	-1.7
	Received	1,383	1,358	1,274	1,127	1,092	1,100	1,050	-1.6	-0.5
Lower Mississippi	Shipped	661	644	583	481	444	428	384	-2.4	-1.7
	Received	1,876	1,834	1,704	1,482	1,417	1,409	1,326	-1.8	-0.9
Baton Rouge to Gulf	Shipped	4,721	4,981	5,481	5,494	5,604	5,871	6,056	1.2	0.8
	Received	10,398	10,667	13,313	15,102	17,268	22,483	20,143	2.9	2.2
Illinois River	Shipped	3,571	3,492	3,195	2,678	2,496	2,427	2,206	-2.2	-1.5
	Received	6,450	6,193	5,637	4,935	4,594	4,475	4,274	-2.0	-1.1
Missouri River	Shipped	3,049	2,970	2,689	2,216	2,044	1,972	1,767	-2.4	-1.7
	Received	3,166	3,090	2,820	2,361	2,204	2,149	1,956	-2.2	-1.4
Ohio River	Shipped	19,451	18,924	17,145	14,212	13,111	12,627	11,355	-2.4	-1.7
	Received	19,352	18,890	17,358	14,808	13,945	13,674	12,619	-2.0	-1.2
Tennessee River	Shipped	2,551	2,485	2,250	1,855	1,711	1,650	1,479	-2.4	-1.7
	Received	2,927	2,871	2,688	2,368	2,289	2,299	2,187	-1.6	-0.6
Arkansas River	Shipped	2,989	2,911	2,636	2,172	2,004	1,933	1,732	-2.4	-1.7
	Received	3,017	2,939	2,663	2,199	2,030	1,960	1,759	-2.4	-1.7
Gulf Coast West	Shipped	12,268	12,654	13,450	13,687	14,302	15,139	15,563	0.8	1.0
	Received	6,705	6,747	6,700	6,404	6,444	6,613	6,572	-0.4	0.2
Gulf Coast East	Shipped	9,985	10,094	12,489	14,207	16,218	21,302	18,924	2.7	2.2
	Received	5,202	5,688	6,634	6,763	6,944	7,171	7,284	2.0	0.6
Warrior River System	Shipped	2,465	2,382	2,168	1,856	1,718	1,642	1,509	-2.2	-1.6
	Received	1,792	1,757	1,633	1,420	1,360	1,357	1,277	-1.8	-0.8
South Atlantic Coast	Shipped	758	788	813	788	757	740	727	0.3	0.6
	Received	1,132	1,173	1,218	1,269	1,312	1,371	1,404	0.9	0.8
Middle Atlantic Coast	Shipped	9,018	10,133	8,992	6,954	4,647	3,956	3,074	2.0	-6.1
	Received	10,129	11,340	10,138	7,978	5,526	4,810	3,880	-1.8	5.4

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SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic	Shipped	950	1,069	947	728	481	406	312	2.0	-6.3
Coast	Received	342	380	346	283	211	192	165	-1.5	-4.1
Great Lakes and	Shipped	31,238	36,619	43,423	47,530	50,555	56,482	59,381	3.3	1.7
Seaway	Received	29,710	35,176	42,107	46,324	49,448	55,462	58,407	3.5	1.8
Washington/Oregon	Shipped	2,551	2,591	2,357	1,952	1,699	1,623	1,454	-2.0	-2.2
Coast	Received	2,719	2,785	2,524	2,070	1,761	1,669	1,478	-2.1	-2.6
Columbia Snake	Shipped	4,842	4,760	4,305	3,536	3,208	3,080	2,747	-2.4	-1.9
Willamette River	Received	4,597	4,484	4,061	3,349	3,084	2,976	2,666	-2.4	-1.7
California Coast	Shipped	714	786	710	579	431	383	325	-1.6	4.3
	Received	853	930	866	697	511	424	343	-1.5	-5.3
Alaska	Shipped	24	26	24	19	13	11	9	-1.9	-5.5
	Received	100	108	101	88	74	70	64	-1.0	-2.4
Hawaii and Pacific	Shipped	49	55	49	38	26	22	17	-2.0	-6.0
Territories	Received	68	75	68	55	41	36	30	-1.6	-4.5
Domestic Caribbean	Shipped	2	1	1	1	1	1	1	-3.3	-2.7
	Received	45	46	44	41	38	36	35	0.6	-1.2
Total	Shipped	114,959	121,387	126,444	123,251	123,558	133,710	130,830	0.5	0.5
	Received	114,959	121,387	126,444	123,251	123,558	133,710	130,830	0.5	0.5

a = less than 500 tons

4/15/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY Nonmetallic Minerals
ALTERNATIVE Largergovt2003A

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	562	580	614	654	700	752	787	1.2	1.4
	Imports	1,230	1,286	1,582	1,779	1,977	2,247	2,430	2.9	2.4
Illinois River	Exports	282	306	352	405	466	536	584	2.8	2.8
	Imports	164	171	211	250	292	343	378	3.3	3.2
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	965	976	998	1,023	1,051	1,084	1,106	0.5	0.6
	Imports	1,667	1,751	2,203	2,565	2,945	3,428	3,763	3.4	3.0
Gulf Coast East	Exports	12,499	12,987	13,804	10,784	7,769	4,760	2,958	-1.1	-9.5
	Imports	2,551	2,786	3,533	3,872	4,229	4,681	4,995	3.3	2.0
Warrior River System	Exports	4	4	5	5	6	7	8	2.8	2.8
	Imports	1	1	2	2	2	3	3	3.0	3.1
South Atlantic Coast	Exports	2,730	2,887	3,168	2,959	2,779	2,634	2,566	0.6	-1.1
	Imports	2,273	2,276	2,660	2,736	2,791	2,954	3,066	1.4	0.9
Middle Atlantic Coast	Exports	109	119	136	156	179	205	223	2.8	2.8
	Imports	5,258	5,308	6,315	6,703	7,069	7,701	8,142	1.9	1.5

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SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Exports	3	3	3	4	4	5	5	2.7	2.7
	Imports	1,044	1,074	1,307	1,479	1,662	1,899	2,065	2.7	2.6
Great Lakes and Seaway	Exports	3,500	3,807	4,379	5,037	5,794	6,665	7,249	2.8	2.8
	Imports	2,208	2,262	2,501	2,729	2,978	3,278	3,489	1.6	1.9
Washington/Oregon Coast	Exports	1,107	1,204	1,384	1,593	1,832	2,107	2,292	2.8	2.8
	Imports	1,902	1,967	2,258	2,454	2,650	2,916	3,098	2.0	1.8
Columbia-Snake Willamette River	Exports	111	121	139	160	184	211	230	2.8	2.8
	Imports	1,021	1,050	1,182	1,284	1,388	1,524	1,617	1.8	1.8
California Coast	Exports	858	933	1,073	1,234	1,419	1,632	1,775	2.8	2.8
	Imports	1,323	1,414	1,864	2,080	2,273	2,583	2,783	3.5	2.3
Alaska	Exports	166	181	208	239	275	316	344	2.8	2.8
	Imports	24	25	27	29	32	34	36	1.5	1.6
Hawaii and Pacific Territories	Exports	19	21	24	28	32	37	40	2.8	2.8
	Imports	45	46	50	52	53	55	57	1.0	0.7
Domestic Caribbean	Exports	118	120	122	124	127	130	132	0.4	0.5
	Imports	273	286	356	410	466	538	588	3.2	2.8
Total	Exports	23,031	24,247	26,410	24,404	22,617	21,083	20,299	0.4	-1.4
	Imports	20,985	21,705	26,051	28,425	30,807	34,182	36,514	2.4	1.9

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL, AND THROUGH

COMMODITY Nonmetallic Minerals
ALTERNATIVE Largerdavt2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	2,997	2,853	2,547	2,127	1,965	1,975	1,883	-2.6	0.9
Lower Upper Mississippi	4,276	4,082	3,768	3,436	3,312	3,441	3,513	-1.7	0.2
Lower Mississippi	8,263	8,058	7,744	7,361	7,374	7,740	7,901	-0.9	0.5
Baton Rouge to Gulf	17,576	17,924	20,938	22,845	25,274	31,031	29,094	2.0	1.9
Illinois River	6,635	6,388	5,945	5,146	4,813	4,705	4,509	1.9	-1.0
Missouri River	3,218	3,140	2,865	2,399	2,238	2,182	1,986	-2.2	1.4
Ohio River	22,146	21,631	19,933	17,091	16,159	15,907	14,771	-2.0	-1.1
Tennessee River	3,329	3,262	3,042	2,560	2,558	2,559	2,420	-1.7	-0.7
Arkansas River	3,018	2,940	2,664	2,200	2,031	1,961	1,759	2.4	-1.7
Gulf Coast West	13,681	14,066	14,862	15,091	15,720	16,583	17,016	0.8	0.9
Gulf Coast East	14,058	14,605	17,931	19,840	22,050	27,364	25,125	2.7	1.8
Warrior River System	2,661	2,580	2,378	2,080	1,960	1,906	1,789	1.9	-1.2
Great Lakes	31,287	36,669	43,474	47,580	50,607	56,538	59,438	3.3	1.7

* = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY Nonmetallic Minerals
ALTERNATIVE Largergovt2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	400	368	320	272	253	271	280	2.9	0.2
Lower Upper Mississippi	693	656	605	562	545	575	602	1.6	0.5
Lower Mississippi	4,698	4,578	4,434	4,296	4,343	4,6[illegible]	4,764	-0.7	0.8
Baton Rouge to Gulf	2,141	2,151	2,528	2,782	3,104	3,928	3,611	2.0	2.0
Illinois River	605	579	533	483	455	448	440	-1.7	-0.7
Missouri River	394	386	358	310	297	295	277	-1.8	-0.9
Ohio River	2,860	2,826	2,727	2,544	2,541	2,615	2,584	-0.9	0.1
Tennessee River	294	290	277	254	251	258	252	-1.1	0.0
Arkansas River	45	44	40	34	32	31	28	-2.2	-1.5
Gulf Coast West	1,319	1,366	1,467	1,490	1,547	1,625	1,664	0.9	0.9
Gulf Coast East	582	616	692	707	727	764	771	1.5	0.7
Warrior River System	221	214	196	168	157	152	141	2.1	-1.4
Great Lakes	9,607	11,148	13,090	14,256	15,117	16,824	17,562	3.1	1.7
Total	23,859	25,222	27,267	28,160	29,368	32,388	33,075	1.3	1.2

a = less than 500,000 ton-miles

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY Food and Kindred Products
ALTERNATIVE Largergovt2003A

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Shipped	1,486	1,864	2,119	2,473	2,563	2,183	2,368	4.0	-0.3
	Received	169	173	177	180	183	188	190	0.5	0.4
Lower Upper Mississippi	Shipped	1,818	2,324	2,647	3,149	3,264	2,697	2,947	4.3	-0.5
	Received	156	160	165	170	175	182	187	0.7	0.7
Lower Mississippi	Shipped	1,304	1,671	1,916	2,263	2,349	1,968	2,149	4.3	-0.4
	Received	128	130	135	139	144	151	157	0.7	0.9
Baton Rouge to Gulf	Shipped	1,310	1,372	1,441	1,513	1,573	1,627	1,694	1.1	0.9
	Received	7,017	8,896	10,149	11,952	12,410	10,468	11,416	4.2	-0.4
Illinois River	Shipped	556	687	773	901	932	789	856	3.8	-0.4
	Received	471	486	505	522	540	565	583	0.8	0.9
Missouri River	Shipped	559	687	775	894	925	800	863	3.7	-0.3
	Received	180	185	189	193	196	201	204	0.5	0.4
Ohio River	Shipped	338	425	480	567	587	485	530	4.1	-0.5
	Received	234	239	245	252	260	270	278	0.6	0.7
Tennessee River	Shipped	540	686	788	919	955	819	888	4.2	-0.3
	Received	170	170	170	170	170	170	171	0.0	0.0
Arkansas River	Shipped	140	180	206	247	256	208	229	4.5	-0.6
	Received	38	38	39	40	40	41	42	0.4	0.3
Gulf Coast West	Shipped	760	811	850	897	917	897	925	1.3	0.2
	Received	486	501	517	530	543	560	571	0.7	0.6
Gulf Coast East	Shipped	450	485	519	556	583	603	631	1.6	1.0
	Received	122	130	139	147	155	166	174	1.5	1.3
Warrior River System	Shipped	88	95	100	108	110	104	109	1.6	0.1
	Received	37	37	37	38	38	38	38	0.1	0.1
South Atlantic Coast	Shipped	328	358	393	426	459	502	532	2.0	1.7
	Received	290	319	354	386	417	459	488	2.2	1.8
Middle Atlantic Coast	Shipped	1,289	1,400	1,539	1,659	1,775	1,930	2,046	2.0	1.6
	Received	984	1,065	1,169	1,257	1,342	1,458	1,544	1.9	1.6

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SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Shipped	62	66	72	78	83	90	95	1.8	1.6
	Received	32	34	36	38	39	42	44	1.3	1.2
Great Lakes and Seaway	Shipped	322	322	322	322	322	322	322	0.0	0.0
	Received	322	322	322	322	322	322	322	0.0	0.0
Washington/Oregon Coast	Shipped	361	395	436	475	514	565	602	2.1	1.8
	Received	228	249	273	296	318	347	368	2.0	1.7
Columbia Snake Willamette River	Shipped	60	61	69	75	82	91	98	1.7	2.1
	Received	85	91a	98	104	109	117	123	1.5	1.3
California Coast	Shipped	1,135	1,253	1,405	1,554	1,708	1,909	2,051	2.4	2.2
	Received	1,826	2,013	2,238	2,445	2,649	2,921	3,113	2.3	1.9
Alaska	Shipped	167	184	205	224	242	267	285	2.3	1.9
	Received	309	340	378	412	446	491	523	2.2	1.9
Hawaii and Pacific Territories	Shipped	2,069	2,282	2,543	2,785	3,027	3,348	3,575	2.3	1.9
	Received	1,055	1,167	1,318	1,471	1,635	1,845	1,993	2.6	2.4
Domestic Caribbean	Shipped	494	529	568	604	640	688	721	1.6	1.4
	Received	1,295	1,395	1,514	1,625	1,735	1,882	1,987	1.8	1.6
Total	Shipped	15,634	18,137	20,166	22,687	23,856	22,883	24,514	2.9	0.6
	Received	15,634	18,137	20,166	22,687	23,866	22,883	24,514	2.9	0.6

a = less than 500 tons

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY Food and Kindred Products
ALTERNATIVE Largergovt2003A

SEGMENT	EXP/IMP	1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	8,246	10,096	11,371	13,151	13,612	11,721	12,659	3.7	-0.3
	Imports	2,649	2,763	3,354	3,975	4,807	5,843	6,602	3.2	4.0
Illinois River	Exports	230	275	307	352	365	321	345	3.3	-0.2
	Imports	23	24	29	34	41	49	56	3.0	3.9
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	1,094	1,246	1,391	1,535	1,594	1,511	1,595	2.6	0.3
	Imports	1,000	1,031	1,247	1,474	1,784	2,164	2,438	3.0	3.9
Gulf Coast East	Exports	712	851	952	1,096	1,135	988	1,066	3.4	0.2
	Imports	396	408	492	581	702	851	958	3.0	3.9
Warrior River System	Exports	113	135	150	173	179	156	168	3.4	0.2
	Imports	42	43	48	54	62	72	79	2.0	2.9
South Atlantic Coast	Exports	532	580	641	694	722	712	746	2.1	0.6
	Imports	554	570	689	814	985	1,194	1,345	3.0	3.9
Middle Atlantic Coast	Exports	1,394	1,543	1,706	1,870	1,943	1,872	1,973	2.3	0.4
	Imports	5,951	6,138	7,397	8,687	10,455	12,623	14,192	3.0	3.8

4/16/80

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Exports	53	54	59	63	65	68	70	1.3	0.9
	Imports	720	742	838	1,063 a	1,787	1,562	1,760	3.0	4.0
Great Lakes and Seaway	Exports	470	531	587	656	681	632	672	2.6	0.2
	Imports	69	71	8[illegible]	102	124	151	170	3.0	4.0
Washington/Oregon Coast	Exports	621	710	787	885	918	841	897	2.8	0.1
	Imports	130	134	163	192	233	282	318	3.0	3.9
Columbia Snake Willamette River	Exports	150	157	172	183	191	194	202	1.5	0.8
	Imports	131	140	169	197	234	281	318	3.2	3.7
California Coast	Exports	1,604	1,732	1,907	2,054	2,137	2,130	2,228	1.9	0.6
	Imports	1,190	1,252	1,508	1,774	2,123	2,564	2,892	3.1	3.8
Alaska	Exports	11	12	13	13	14	15	15	1.2	1.0
	Imports	26	27	31	36	43	51	56	2.5	3.5
Hawaii and Pacific Territories	Exports	9	10	11	12	12	12	13	2.0	0.5
	Imports	33	34	39	45	53	63	70	2.4	3.4
Domestic Caribbean	Exports	103	117	130	145	151	139	149	2.7	0.2
	Imports	390	400	469	543	643	765	853	2.6	3.5
Total	Exports	15,344	18,050	20,183	22,883	23,718	21,313	22,798	3.1	0.0
	Imports	13,305	13,776	16,611	19,572	23,575	28,514	32,107	3.0	3.9

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL, AND THROUGH
COMMODITY Food and Kindred Products
ALTERNATIVE largergovt2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	1,651	2,033	2,293	2,650	2,743	2,367	2,555	3.7	-0.3
Lower Upper Mississippi	5,321	6,491	7,274	8,405	8,701	7,514	8,116	3.6	0.3
Lower Mississippi	7,691	9,508	10,731	12,479	12,939	11,104	12,035	3.8	-0.3
Baton Rouge to Gulf	8,453	10,378	11,692	13,551	14,068	12,206	13,213	3.7	-0.2
Illinois River	1,018	1,163	1,267	1,413	1,461	1,343	1,428	2.6	0.1
Missouri River	739	872	964	1,087	1,122	1,001	1,066	3.0	-0.1
Ohio River	1,243	1,481	1,645	1,870	1,933	1,706	1,828	3.2	-0.2
Tennessee River	709	855	958	1,089	1,125	989	1,058	3.4	-0.2
Arkansas River	177	219	245	286	296	249	271	3.8	-0.4
Gulf Coast West	866	922	968	1,021	1,047	1,034	1,067	1.3	0.3
Gulf Coast East	579	624	668	715	748	767	803	1.6	0.9
Warrior River System	125	132	138	145	148	142	147	1.2	0.1
Great Lakes	322	322	322	322	322	322	322	0.0	0.0

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY Food and Kindred Products
ALTERNATIVE Largergovt2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77 90	90 03
Upper Mississippi	566	697	786	908	940	811	875	3.7	0.3
Lower Upper Mississippi	1,101	1,343	1,505	1,739	1,800	1,555	1,680	3.6	0.3
Lower Mississippi	4,905	6,059	6,835	7,946	8,239	7,075	7,667	3.8	-0.3
Baton Rouge to Gulf	964	1,176	1,321	1,525	1,582	1,379	1,490	3.6	-0.2
Illinois River	253	289	315	351	363	333	354	2.6	0.1
Missouri River	451	532	588	663	684	611	650	3.0	0.1
Ohio River	247	283	308	345	356	323	344	2.6	0.0
Tennessee River	256	309	346	393	406	357	382	3.4	-0.2
Arkansas River	62	76	86	100	104	87	95	3.8	-0.4
Gulf Coast West	88	98	105	116	119	110	116	2.1	0.0
Gulf Coast East	16	17	18	19	20	19	20	1.7	0.1
Warrior River System	4	4	4	4	4	4	4	1.2	0.1
Great Lakes	88	88	88	88	88	88	88	0.0	0.0
Total	8,999	10,970	12,304	14,197	14,705	12,753	13,766	3.6	0.2

a = less than 500,000 ton-miles

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY Lumber and Wood Products
ALTERNATIVE Largergovt2003A

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Shipped	12	17	19	19	20	20	21	3.4	0.5
	Received	7	12	14	14	15	15	15	5.1	0.6
Lower Upper Mississippi	Shipped	18	19	20	21	21	21	22	1.0	0.4
	Received	23	23	26	26	27	27	28	0.9	0.5
Lower Mississippi	Shipped	441	454	506	512	528	544	552	1.1	0.6
	Received	428	450	488	501	514	528	536	1.2	0.5
Baton Rouge to Gulf	Shipped	140	142	164	161	167	173	174	1.1	0.6
	Received	136	136	149	152	156	160	162	0.9	0.5
Illinois River	Shipped	20	21	22	22	22	23	23	0.7	0.3
	Received	78	73	101	90	96	102	102	1.1	1.0
Missouri River	Shipped	3	3	3	3	3	3	3	1.2	0.5
	Received	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Shipped	35	36	39	[illegible]	42	43	43	1.2	0.5
	Received	8	8	8	8	8	8	8	0.4	0.9
Tennessee River	Shipped	361	374	410	419	431	444	450	1.2	0.6
	Received	361	374	410	419	431	444	450	1.2	0.6
Arkansas River	Shipped	12	12	14	14	14	15	15	1.2	0.6
	Received	5	5	5	5	5	5	5	1.0	0.5
Gulf Coast West	Shipped	65	64	66	66	66	66	67	0.1	0.1
	Received	37	35	32	31	30	29	28	-1.3	-0.8
Gulf Coast East	Shipped	13	12	14	14	15	15	16	0.7	0.7
	Received	101	106	114	117	121	124	126	1.2	0.5
Warrior River System	Shipped	431	447	491	502	517	532	540	1.2	0.6
	Received	284	298	322	330	338	347	352	1.1	0.5
South Atlantic Coast	Shipped	726	680	647	591	551	516	494	-1.6	-1.4
	Received	393	367	328	294	264	237	222	-2.2	-2.1
Middle Atlantic Coast	Shipped	343	305	383	380	412	444	453	0.8	1.4
	Received	679	611	684	658	681	[illegible]	706	-0.2	0.5

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4/16/80

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Shipped	a	a	a	a	a	a	a	0.8	1.3
	Received	a	a	a	a	a	1	1	1.8	1.9
Great Lakes and Seaway	Shipped	177	161	160	160	161	161	161	-0.8	0.0
	Received	177	161	160	160	161	161	161	-0.8	0.0
Washington/Oregon Coast	Shipped	8,948	11,183	10,521	11,112	11,143	11,408	11,483	1.7	0.3
	Received	7,991	10,429	9,577	10,150	10,147	10,397	10,469	1.9	0.2
Columbia Snake Willamette River	Shipped	9,790	12,636	11,706	12,418	12,447	12,770	12,873	1.8	0.3
	Received	9,562	12,456	11,494	12,204	12,228	12,550	12,653	1.9	0.3
California Coast	Shipped	30	25	30	30	31	32	32	0.1	0.3
	Received	810	633	795	812	838	847	847	0.0	0.3
Alaska	Shipped	1,556	2,136	2,058	2,187	2,217	2,286	2,311	2.7	0.4
	Received	1,731	2,276	2,239	2,370	2,408	2,481	2,510	2.4	0.4
Hawaii and Pacific Territories	Shipped	76	84	100	106	113	120	125	2.6	1.2
	Received	280	253	303	311	323	332	337	0.8	0.6
Domestic Caribbean	Shipped	6	5	3	3	2	2	2	-6.1	-2.6
	Received	121	116	134	134	139	144	145	0.8	0.7
Total	Shipped	23,204	28,815	27,377	28,780	28,922	29,638	29,858	1.7	0.3
	Received	23,204	28,815	27,377	28,780	28,922	29,638	29,858	1.7	0.3

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY: Lumber and Wood Products
ALTERNATIVE: Largergovt20C3A

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	108	117	146	148	157	167	168	2.5	1.0
	Imports	175	149	187	171	171	185	182	-0.1	0.5
Illinois River	Exports	5	5	6	5	5	5	5	-1.0	0.0
	Imports	1	1	1	1	1	1	1	-0.2	0.1
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	274	323	510	597	631	635	636	6.2	0.5
	Imports	208	181	230	213	213	232	228	0.2	0.5
Gulf Coast East	Exports	35	63	85	98	107	112	113	8.3	1.1
	Imports	77	68	94	93	92	107	103	1.5	0.8
Warrior River System	Exports	111	160	206	235	259	275	277	5.9	1.3
	Imports	93	82	108	110	109	125	120	1.3	0.7
South Atlantic Coast	Exports	441	556	788	891	951	974	980	5.6	0.7
	Imports	600	522	634	582	572	613	601	0.2	0.2
Middle Atlantic Coast	Exports	257	325	448	432	447	467	476	4.1	0.7
	Imports	1,414	1,180	1,527	1,456	1,390	1,572	1,512	0.2	0.3

4/16/80

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Exports	11	13	19	16	16	16	17	2.7	0.5
	Imports	261	213	284	275	260	300	286	0.4	0.3
Great Lakes and Seaway	Exports	50	60	322	398	405	412	406	17.3	0.1
	Imports	9	8	a	8	7	7	7	-1.6	-0.6
Washington/Oregon Coast	Exports	13,485	11,826	11,934	9,530	8,731	8,410	8,233	-2.6	-1.1
	Imports	2,689	2,529	3,093	3,193	3,227	3,609	3,516	1.3	0.7
Columbia Snake Willamette River	Exports	5,470	4,816	4,853	3,881	3,556	3,427	3,353	-2.6	1.1
	Imports	160	140	177	162	164	178	175	0.1	0.6
California Coast	Exports	1,579	1,446	1,504	1,322	1,196	1,120	1,076	-1.4	-1.6
	Imports	479	419	581	579	589	682	660	1.5	1.0
Alaska	Exports	989	1,001	938	839	779	744	733	1.3	-1.0
	Imports	233	230	240	240	241	247	246	0.2	0.2
Hawaii and Pacific Territories	Exports	40	38	44	43	40	37	36	0.5	-1.3
	Imports	8	7	10	10	10	11	11	1.2	0.8
Domestic Caribbean	Exports	5	6	7	8	7	7	7	3.9	-0.2
	Imports	158	134	188	188	186	218	209	1.3	0.8
Total	Exports	22,859	20,754	21,812	18,442	17,285	16,808	16,515	-1.6	-0.8
	Imports	6,565	5,864	7,361	7,283	7,232	8,088	7,859	0.8	0.6

a = less than 500 tons

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WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC INBOUND, OUTBOUND, LOCAL, AND THROUGH
COMMODITY Lumber and Wood Products
ALTERNATIVE Largergovt2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77 90	90 03
Upper Mississippi	15	20	22	22	23	24	24	3 0	0 6
Lower Upper Mississippi	133	128	161	151	159	166	167	1 0	0 8
Lower Mississippi	555	569	641	643	665	686	695	1 1	0 6
Baton Rouge to Gulf	190	188	217	213	221	228	230	0 9	0 6
Illinois River	98	94	123	112	118	125	125	1 1	0 8
Missouri River	3	3	3	3	3	3	3	1 2	0 5
Ohio River	35	37	40	41	42	43	44	1 2	0 5
Tennessee River	361	374	410	419	431	444	450	1 2	0 6
Arkansas River	12	13	14	14	15	15	15	1.1	0 6
Gulf Coast West	72	71	73	72	72	73	73	0 0	0 0
Gulf Coast East	124	127	140	142	146	150	152	1 0	0 5
Warrior River System	444	457	502	512	527	542	549	1 1	0 5
Great Lakes	177	161	160	160	161	161	161	-0 8	0 0

a - less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON-MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY Lumber and Wood Products
ALTERNATIVE Largergovt2003A

SEGMENT	1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
Upper Mississippi	3	3	3	3	3	4	4	0.8	0.6
Lower Upper Mississippi	25	24	31	29	30	32	32	1.0	0.8
Lower Mississippi	137	137	162	158	164	171	172	1.1	0.7
Baton Rouge to Gulf	25	24	29	28	29	30	30	0.8	0.7
Illinois River	26	24	32	29	31	33	33	1.1	0.8
Missouri River	a	a	1	1	1	1	1	1.2	0.5
Ohio River	13	14	15	15	16	16	16	1.2	0.5
Tennessee River	42	43	48	49	50	51	52	1.2	0.6
Arkansas River	1	1	1	1	1	1	1	1.2	0.6
Gulf Coast West	2	2	2	2	2	2	2	-1.0	-0.5
Gulf Coast East	9	9	10	10	10	10	11	1.0	0.5
Warrior River System	45	47	51	52	54	55	56	1.2	0.5
Great Lakes	45	40	40	40	40	40	40	-0.9	0.0
Total	373	369	424	416	431	445	449	0.8	0.6

a = less than 500,000 ton-miles

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY: Pulp, Paper and Allied Products
ALTERNATIVE: Largergovt2003A

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Shipped	1	1	1	1	1	2	2	2.4	2.1
	Received	14	14	15	16	16	16	16	0.8	0.4
Lower Upper Mississippi	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	6	6	6	6	6	7	7	0.8	0.4
Lower Mississippi	Shipped	195	202	216	224	232	241	247	1.0	0.8
	Received	3	3	3	4	4	4	4	0.8	0.4
Baton Rouge to Gulf	Shipped	102	109	121	132	143	155	163	2.0	1.7
	Received	466	487	523	548	575	604	622	1.3	1.0
Illinois River	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	29	31	36	40	44	49	52	2.4	2.1
Missouri River	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	6	6	7	7	7	7	7	0.8	0.4
Ohio River	Shipped	3	3	3	3	3	3	3	0.8	0.4
	Received	13	14	14	15	15	15	16	0.8	0.4
Tennessee River	Shipped	163	171	185	195	205	217	225	1.4	1.1
	Received	131	138	150	159	169	180	187	1.5	1.3
Arkansas River	Shipped	118	122	128	131	133	136	138	0.8	0.4
	Received	4	4	4	5	5	6	6	2.4	2.1
Gulf Coast West	Shipped	47	49	52	54	56	59	60	1.1	0.9
	Received	39	40	42	42	43	44	45	0.7	0.4
Gulf Coast East	Shipped	138	145	157	166	176	186	193	1.4	1.2
	Received	28	29	31	32	34	35	36	1.1	0.8
Warrior River System	Shipped	17	18	20	21	23	25	26	1.8	1.6
	Received	9	9	10	11	11	12	12	1.3	1.1
South Atlantic Coast	Shipped	379	406	457	488	521	556	579	2.0	1.3
	Received	53	57	63	69	75	82	86	1.9	1.7
Middle Atlantic Coast	Shipped	108	108	114	119	125	130	134	0.8	0.9
	Received	254	272	304	325	348	372	387	1.9	1.4

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4/16/80

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Shipped	2	2	3	3	3	3	3	1.8	0.8
	Received	1	1	1	1	1	1	1	1.8	1.0
Great Lakes and Seaway	Shipped	434	437	441	444	446	448	450	0.2	0.1
	Received	434	437	441	444	446	448	450	0.2	0.1
Washington/Oregon Coast	Shipped	381	411	477	513	545	578	599	2.3	1.2
	Received	456	491	575	627	670	713	741	2.5	1.3
Columbia-Snake Willamette River	Shipped	1,736	1,879	2,172	2,313	2,446	2,583	2,670	2.2	1.1
	Received	1,708	1,850	2,141	2,281	2,413	2,549	2,635	2.3	1.1
California Coast	Shipped	66	69	74	76	78	80	81	1.1	0.5
	Received	13	7	a	a	a	a	a	-29.7	2.5
Alaska	Shipped	115	123	146	163	176	188	197	2.7	1.5
	Received	20	22	26	27	28	30	31	2.1	1.0
Hawaii and Pacific Territories	Shipped	40	48	63	68	74	80	84	4.1	1.6
	Received	149	162	185	194	203	212	218	2.0	0.9
Domestic Caribbean	Shipped	9	9	10	11	11	11	12	1.4	0.7
	Received	217	233	262	273	285	298	306	1.8	0.9
Total	Shipped	4,055	4,312	4,841	5,124	5,398	5,683	5,866	1.8	1.0
	Received	4,055	4,312	4,841	5,124	5,398	5,683	5,866	1.8	1.0

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY Pulp, Paper and Allied Products
ALTERNATIVE Largergovt2003

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	829	918	1,117	1,227	1,352	1,458	1,542	3.1	1.8
	Imports	92	79	56	44	37	31	30	-5.5	-3.0
Illinois River	Exports	2	2	3	3	4	4	5	3.1	2.2
	Imports	72	74	77	78	80	82	83	0.6	0.5
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	261	287	346	388	430	471	502	3.1	2.0
	Imports	26	22	16	12	11	9	8	-5.5	-3.0
Gulf Coast East	Exports	260	287	347	387	428	467	496	3.1	1.9
	Imports	34	29	21	16	14	11	11	-5.5	-3.0
Warrior River System	Exports	142	158	195	210	229	244	256	3.0	1.5
	Imports	104	96	85	78	74	71	69	-2.2	-0.9
South Atlantic Coast	Exports	1,458	1,614	2,044	2,243	2,464	2,652	2,738	3.4	1.5
	Imports	359	335	302	275	254	247	228	-2.0	-1.4
Middle Atlantic Coast	Exports	389	428	527	595	659	725	768	3.3	2.0
	Imports	642	590	519	461	415	379	362	-2.5	-1.9

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SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
North Atlantic Coast	Exports	64	71	89	98	109	118	123	3.3	1.7
	Imports	87	85	83	81	80	78	77	-0.5	0.4
Great Lakes and Seaway	Exports	3	4	4	5	5	6	6	2.5	2.0
	Imports	345	346	352	348	345	342	343	0.1	-0.1
Washington/Oregon Coast	Exports	682	686	656	628	648	640	643	0.6	0.2
	Imports	242	237	230	220	210	202	198	0.7	0.8
Columbia-Snake Willamette River	Exports	269	266	253	247	254	254	257	-0.7	0.3
	Imports	1	1	1	1	1	1	1	-1.6	-1.4
California Coast	Exports	380	387	372	351	364	355	355	-0.6	0.1
	Imports	606	580	542	502	466	439	423	-1.4	-1.3
Alaska	Exports	252	259	250	233	242	234	233	-0.6	0.0
	Imports	13	12	12	11	10	9	9	-1.5	-1.4
Hawaii and Pacific Territories	Exports	a	a	a	a	a	a	a	2.6	2.0
	Imports	24	22	20	18	16	15	14	-2.1	-1.7
Domestic Caribbean	Exports	21	23	26	30	33	36	39	2.6	2.0
	Imports	37	34	31	28	25	23	22	-2.1	1.7
Total	Exports	5,015	5,391	6,231	6,645	7,221	7,666	7,962	2.2	1.4
	Imports	2,683	2,543	2,346	2,174	2,037	1,930	1,878	-1.6	-1.1

a - less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL, AND THROUGH
COMMODITY Pulp, Paper and Allied Products
ALTERNATIVE Largegovt2003A

SEGMENT	YEARS 1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	15	15	16	17	17	18	18	0.9	0.6
Lower Upper Mississippi	56	59	65	69	74	80	84	1.7	1.4
Lower Mississippi	369	383	408	424	441	458	470	1.1	0.8
Baton Rouge to Gulf	551	576	621	652	685	721	744	1.3	1.0
Illinois River	29	31	36	40	44	49	52	2.4	2.1
Missouri River	6	6	7	7	7	7	7	0.8	0.4
Ohio River	44	46	48	49	50	51	52	0.8	0.4
Tennessee River	163	171	185	195	205	217	225	1.4	1.1
Arkansas River	122	126	132	136	139	142	144	0.8	0.5
Gulf Coast West	68	70	74	77	80	83	85	1.0	0.7
Gulf Coast East	182	190	206	218	231	244	253	1.4	1.2
Warrior River System	26	27	30	32	34	36	38	1.6	1.4
Great Lakes	434	437	441	444	446	448	450	0.2	0.1

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON-MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY Pulp, Paper and Allied Products
ALTERNATIVE Largergovt2003A

SEGMENT	1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
Upper Mississippi	7	8	8	8	8	9	9	0.9	0.6
Lower Upper Mississippi	12	13	14	15	16	17	18	1.7	1.5
Lower Mississippi	108	112	121	126	132	138	142	1.2	0.9
Baton Rouge to Gulf	55	58	63	66	69	73	75	1.3	1.1
Illinois River	3	3	3	4	4	5	5	2.4	2.1
Missouri River	4	4	4	4	4	4	4	0.8	0.4
Ohio River	10	10	10	11	11	11	11	0.8	0.4
Tennessee River	19	20	21	21	22	23	23	0.9	0.6
Arkansas River	10	11	11	12	12	12	12	0.8	0.5
Gulf Coast West	12	12	13	14	14	15	15	1.0	0.7
Gulf Coast East	29	31	33	36	38	40	42	1.5	1.3
Warrior River System	1	1	1	1	1	1	1	1.6	1.4
Great Lakes	119	120	121	122	122	123	123	0.2	0.1
Total	389	401	424	438	454	471	482	0.9	0.7

a = less than 500,000 ton-miles

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY Chemicals
ALTERNATIVE Largergovt2003A

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77 90	90 03
Upper Mississippi	Shipped	372	429	537	631	762	1,003	1,000	4.2	3.6
	Received	1,900	2,127	2,708	3,195	3,809	5,008	4,910	4.1	3.4
Lower Upper Mississippi	Shipped	508	555	674	775	961	1,339	1,380	3.3	4.5
	Received	873	931	1,131	1,292	1,474	1,744	1,839	3.1	2.8
Lower Mississippi	Shipped	792	862	1,049	1,209	1,421	1,791	1,818	3.3	3.2
	Received	971	1,027	1,226	1,405	1,607	1,848	1,959	2.9	2.6
Baton Rouge to Gulf	Shipped	13,099	14,125	17,297	19,746	22,277	26,085	27,629	3.2	2.6
	Received	4,338	4,665	5,680	6,460	7,219	8,317	9,014	3.1	2.6
Illinois River	Shipped	418	457	561	654	755	895	978	3.5	3.1
	Received	3,767	4,319	5,336	6,158	7,156	8,657	9,260	3.9	3.2
Missouri River	Shipped	135	152	188	221	266	352	351	3.9	3.6
	Received	445	448	476	500	530	572	574	0.9	1.1
Ohio River	Shipped	1,916	2,051	2,481	3,003	4,103	6,103	6,760	3.5	6.4
	Received	6,904	7,331	9,063	10,574	12,568	15,773	17,036	3.3	3.7
Tennessee River	Shipped	580	616	726	863	1,087	1,360	1,447	3.1	4.1
	Received	2,038	2,164	2,640	3,044	3,468	3,983	4,333	3.1	2.8
Arkansas River	Shipped	80	84	98	109	119	134	142	2.4	2.1
	Received	518	560	687	788	905	1,083	1,111	3.3	2.7
Gulf Coast West	Shipped	17,780	19,235	23,334	26,643	29,832	33,919	37,031	3.2	2.6
	Received	10,011	10,855	13,204	15,173	17,163	19,528	21,416	3.3	2.7
Gulf Coast East	Shipped	1,195	1,226	1,480	1,690	1,912	2,201	2,283	2.7	2.3
	Received	1,559	1,601	1,826	1,997	2,163	2,402	2,547	1.9	1.9
Warrior River System	Shipped	416	441	526	593	657	741	804	2.8	2.4
	Received	760	787	909	999	1,087	1,246	1,342	2.1	2.3
South Atlantic Coast	Shipped	1,028	1,061	1,167	1,253	1,325	1,421	1,493	1.5	1.4
	Received	2,160	2,281	2,630	2,911	3,192	3,567	3,852	2.3	2.2
Middle Atlantic Coast	Shipped	2,740	2,830	3,269	3,675	4,140	4,692	5,106	2.3	2.6
	Received	5,544	5,917	7,021	7,910	8,775	9,989	10,880	2.8	2.5

4/16/80

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Shipped	28	27	31	34	37	41	43	2.1	1.9
	Received	663	710	855	970	1,088	1,233	1,345	3.0	2.5
Great Lakes and Seaway	Shipped	629	667	786	911	1,063	1,237	1,376	2.9	3.2
	Received	498	530	621	723	851	1,000	1,117	2.9	3.4
Washington/Oregon Coast	Shipped	786	817	989	1,132	1,271	1,453	1,575	2.8	2.6
	Received	526	546	671	776	877	1,005	1,092	3.0	2.7
Columbia Snake Willamette River	Shipped	226	235	272	301	330	365	390	2.2	2.0
	Received	697	729	857	956	1,051	1,166	1,251	2.5	2.1
California Coast	Shipped	371	339	416	479	547	628	689	2.0	2.8
	Received	1,049	1,121	1,348	1,525	1,711	1,985	2,143	2.9	2.7
Alaska	Shipped	314	326	378	418	464	528	554	2.2	2.2
	Received	124	130	152	171	193	221	240	2.5	2.6
Hawaii and Pacific Territories	Shipped	27	14	18	21	26	30	33	-1.8	3.5
	Received	212	152	193	226	263	305	335	0.5	3.1
Domestic Caribbean	Shipped	2,654	2,895	3,599	4,154	4,700	5,379	5,918	3.5	2.8
	Received	538	512	644	764	908	1,067	1,187	2.7	3.4
Total	Shipped	46,093	49,443	59,878	68,516	78,055	91,699	98,803	3.1	2.9
	Received	46,093	49,443	59,878	68,516	78,055	91,699	98,803	3.1	2.9

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY: Chemicals
ALTERNATIVE: Largergovt2003A

SEGMENT	EXP/IMP	1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	3,410	5,311	5,558	4,774	4,573	4,325	4,176	2.6	1.0
	Imports	1,301	1,217	1,298	1,381	1,601	1,804	1,939	0.5	2.6
Illinois River	Exports	8	12	12	12	12	12	13	2.7	0.4
	Imports	85	80	86	93	108	122	132	0.7	2.8
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	7,208	10,933	9,116	8,462	8,487	8,436	8,418	1.2	0.0
	Imports	1,222	1,104	1,207	1,312	1,403	1,640	1,798	0.6	2.4
Gulf Coast East	Exports	4,032	6,513	9,468	7,256	6,321	5,385	4,825	4.6	-3.1
	Imports	736	1,605	1,627	1,666	1,793	1,909	1,985	6.5	1.4
Warrior River System	Exports	45	68	55	53	55	58	60	1.3	1.0
	Imports	10	10	10	11	12	14	15	1.1	2.1
South Atlantic Coast	Exports	1,021	1,659	2,057	1,797	1,760	1,697	1,664	4.4	0.6
	Imports	927	892	914	962	1,039	1,112	1,160	0.3	1.4
Middle Atlantic Coast	Exports	1,809	2,731	2,836	2,945	3,146	3,226	3,280	3.8	0.8
	Imports	2,772	2,582	2,795	3,021	3,223	3,676	4,000	0.7	2.2

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Exports	20	35	37	39	43	44	45	5.3	1.1
	Imports	111	100	110	120	146	169	185	0.6	3.4
Great Lakes and Seaway	Exports	78	111	107	108	114	118	118	2.5	0.7
	Imports	253	243	252	261	286	309	324	0.3	1.7
Washington/Oregon Coast	Exports	105	143	138	140	150	164	174	2.2	1.7
	Imports	1,427	1,263	1,382	1,501	1,864	2,190	2,414	0.4	3.7
Columbia Snake Willamette River	Exports	41	61	51	47	48	48	48	1.1	0.1
	Imports	1,371	1,215	1,322	1,429	1,763	2,063	2,269	0.3	3.6
California Coast	Exports	1,713	2,466	2,291	2,250	2,324	2,344	2,357	2.1	0.4
	Imports	476	464	485	508	558	607	641	0.5	1.8
Alaska	Exports	325	377	343	331	331	331	331	0.1	0.0
	Imports	33	41	44	47	54	61	65	2.8	2.5
Hawaii and Pacific Territories	Exports	1	1	1	1	1	1	1	3.8	0.9
	Imports	58	57	58	59	61	64	66	0.1	0.9
Domestic Caribbean	Exports	992	1,633	1,217	1,119	1,132	1,134	1,136	0.9	0.1
	Imports	76	73	76	79	86	93	98	0.3	1.7
Total	Exports	20,808	32,057	33,286	29,334	28,498	27,324	26,646	2.7	0.7
	Imports	10,857	10,946	11,666	12,451	13,998	15,834	17,092	1.1	2.5

* = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL, AND THROUGH
COMMODITY Chemicals
ALTERNATIVE Largergovt2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	2,080	2,329	2,966	3,500	4,173	5,471	5,393	4.1	3.4
Lower Upper Mississippi	6,863	7,652	9,411	10,851	12,640	15,609	16,273	3.6	3.2
Lower Mississippi	14,878	16,136	19,862	22,869	26,190	31,208	33,068	3.4	2.9
Baton Rouge to Gulf	21,080	22,756	27,824	31,831	36,030	42,195	45,098	3.2	2.7
Illinois River	4,066	4,640	5,727	6,614	7,681	9,266	9,934	3.8	3.2
Missouri River	538	558	621	676	749	872	874	1.8	2.0
Ohio River	9,603	10,213	12,579	14,682	17,507	21,963	23,794	3.3	3.8
Tennessee River	2,484	2,639	3,204	3,723	4,341	5,098	5,519	3.2	3.1
Arkansas River	595	644	785	897	1,025	1,217	1,253	3.2	2.6
Gulf Coast West	21,058	22,776	27,617	31,589	35,526	40,556	44,345	3.2	2.6
Gulf Coast East	3,619	3,758	4,399	4,899	5,404	6,125	6,478	2.4	2.2
Warrior River System	1,140	1,190	1,392	1,545	1,693	1,929	2,084	2.4	2.3
Great Lakes	700	744	880	1,021	1,189	1,384	1,540	2.9	3.2

* = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY Chemicals
ALTERNATIVE Largergovt2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	788	880	1,124	1,326	1,580	2,068	2,042	4.1	3.4
Lower Upper Mississippi	1,389	1,552	1,910	2,203	2,563	3,154	3,294	3.6	3.1
Lower Mississippi	9,637	10,457	12,887	14,837	16,970	20,194	21,438	3.4	2.9
Baton Rouge to Gulf	2,262	2,441	2,981	3,405	3,849	4,501	4,806	3.2	2.7
Illinois River	937	1,069	1,320	1,524	1,769	2,133	2,287	3.8	3.2
Missouri River	283	294	328	358	397	463	464	1.8	2.0
Ohio River	3,995	4,269	5,280	6,143	7,276	9,104	9,874	3.4	3.7
Tennessee River	578	616	754	879	1,024	1,213	1,316	3.3	3.2
Arkansas River	112	121	147	168	192	229	235	3.2	2.6
Gulf Coast West	3,618	3,899	4,698	5,360	6,032	6,912	7,542	3.1	2.7
Gulf Coast East	458	471	553	615	681	777	826	2.3	2.3
Warrior River System	143	147	172	190	209	237	256	2.2	2.3
Great Lakes	207	218	255	289	328	375	411	2.6	2.7
Total	24,408	26,435	32,407	37,298	42,871	51,361	54,792	3.3	3.0

a = less than 500,000 ton-miles

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY Petroleum and Coal Products
ALTERNATIVE largergovt2003A

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Shipped	1,399	1,451	1,519	1,608	1,718	1,818	1,879	1.1	1.2
	Received	3,035	3,104	3,165	3,272	3,412	3,541	3,616	0.6	0.8
Lower Upper Mississippi	Shipped	6,334	6,424	6,380	6,523	6,710	6,928	7,063	0.2	0.6
	Received	2,891	2,926	2,854	2,848	2,936	3,041	3,111	-0.1	0.7
Lower Mississippi	Shipped	2,006	2,018	2,107	2,248	2,337	2,403	2,430	0.9	0.6
	Received	8,807	8,659	8,688	9,001	9,062	9,133	9,165	0.2	0.1
Baton Rouge to Gulf	Shipped	43,713	43,347	41,145	44,293	44,207	44,477	44,819	0.1	0.1
	Received	19,215	19,327	20,801	24,053	24,025	24,246	24,596	1.7	0.2
Illinois River	Shipped	3,499	3,520	3,483	3,593	3,715	3,849	3,948	0.2	0.7
	Received	6,551	6,549	6,369	6,488	6,706	6,970	7,166	-0.1	0.8
Missouri River	Shipped	168	185	195	209	228	250	265	1.7	1.8
	Received	268	294	309	330	358	391	414	1.6	1.8
Ohio River	Shipped	9,805	9,715	9,503	9,597	9,696	9,831	9,909	-0.2	0.2
	Received	19,035	18,969	18,681	19,200	19,630	20,195	20,558	0.1	0.5
Tennessee River	Shipped	184	187	194	206	212	216	218	0.9	0.5
	Received	1,941	1,932	2,076	2,285	2,471	2,681	2,822	1.3	1.6
Arkansas River	Shipped	1,084	1,062	924	832	785	747	729	-2.0	-1.0
	Received	1,422	1,439	1,346	1,312	1,246	1,188	1,155	-0.6	-1.0
Gulf Coast West	Shipped	81,572	80,931	71,007	74,968	74,965	75,985	77,038	-0.6	0.2
	Received	21,623	22,070	23,800	26,963	27,668	28,679	29,513	1.7	0.7
Gulf Coast East	Shipped	12,002	11,699	11,252	11,417	11,215	11,296	11,425	-0.4	0.0
	Received	19,146	18,466	17,679	17,717	17,286	17,312	17,457	-0.6	-0.1
Warrior River System	Shipped	2,602	2,694	2,864	3,146	3,274	3,439	3,553	1.5	0.9
	Received	3,120	3,131	3,073	3,179	3,272	3,405	3,496	0.1	0.7
South Atlantic Coast	Shipped	7,094	6,276	5,432	5,075	4,068	3,879	3,675	-2.5	-2.5
	Received	31,994	30,887	29,588	29,590	28,691	28,725	29,028	-0.6	-0.1
Middle Atlantic Coast	Shipped	112,406	109,741	104,916	102,865	96,967	91,871	89,050	-0.7	-1.1
	Received	129,100	126,600	113,414	113,194	107,625	102,896	100,406	-1.0	-0.9

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Shipped	8,500	8,749	8,708	8,524	8,100	7,598	7,321	0.0	-1.2
	Received	48,247	48,739	44,135	44,059	43,072	41,961	41,287	-0.7	-0.5
Great Lakes and Seaway	Shipped	5,760	5,628	5,328	5,283	5,258	5,222	5,204	-0.7	-0.1
	Received	6,846	6,759	6,595	6,618	6,595	6,570	6,560	-0.3	-0.1
Washington/Oregon Coast	Shipped	5,774	5,186	5,683	6,274	6,208	6,129	6,105	0.6	-0.1
	Received	5,884	5,298	5,802	6,346	6,353	6,295	6,287	0.6	-0.1
Columbia Snake Willamette River	Shipped	2,130	1,816	2,004	2,185	2,133	2,052	2,013	0.2	-0.6
	Received	5,397	4,803	5,161	5,519	5,392	5,223	5,142	0.2	-0.5
California Coast	Shipped	26,329	20,992	23,861	26,642	25,425	23,840	23,137	0.1	-1.1
	Received	22,495	17,170	19,937	22,586	21,361	19,776	19,082	0.0	-1.3
Alaska	Shipped	2,117	1,865	2,120	2,378	2,356	2,300	2,278	0.9	-0.3
	Received	2,075	2,067	2,300	2,540	2,630	2,611	2,722	1.6	0.5
Hawaii and Pacific Territories	Shipped	1,574	1,286	1,394	1,510	1,417	1,314	1,268	-0.3	-1.3
	Received	1,995	1,668	1,779	1,901	1,793	1,675	1,622	-0.4	-1.2
Domestic Caribbean	Shipped	28,364	29,413	30,861	33,012	33,919	34,680	35,207	1.2	0.5
	Received	3,329	3,329	3,329	3,329	3,329	3,329	3,329	0.0	0.0
Total	Shipped	364,418	354,185	340,880	352,329	344,912	339,924	338,533	-0.3	-0.3
	Received	364,418	354,185	340,880	352,329	344,912	339,924	338,533	-0.3	-0.3

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY Petroleum and Coal Products
ALTERNATIVE Largergovt2003A

SEGMENT	EXP/IMP	1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	1,083	958	848	729	626	537	490	-3.0	3.0
	Imports	278	266	265	271	257	248	244	0.2	-0.8
Illinois River	Exports	500	456	392	337	289	219	227	3.0	3.0
	Imports	a	a	a	a	a	a	a	0.0	0.0
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	3,520	3,213	2,759	2,369	2,034	1,747	1,595	3.0	3.0
	Imports	2,117	2,047	2,020	2,028	1,967	1,920	1,901	-0.3	0.5
Gulf Coast East	Exports	1,250	1,141	980	841	723	620	565	3.0	3.0
	Imports	2,981	2,611	2,446	2,451	2,159	1,920	1,817	1.5	2.3
Warrior River System	Exports	3	2	2	2	2	1	1	-3.0	3.0
	Imports	9	8	8	9	8	8	8	0.2	-1.0
South Atlantic Coast	Exports	27	25	21	18	16	13	12	3.0	-3.0
	Imports	10,434	8,983	8,311	8,310	7,175	6,249	5,842	1.7	2.7
Middle Atlantic Coast	Exports	533	486	417	358	308	264	241	-3.0	3.0
	Imports	46,646	41,181	38,658	38,658	34,381	30,891	29,362	1.4	2.1

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4/16/80

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Exports	35	32	27	23	20	17	16	-3.0	-3.0
	Imports	17,571	15,589	14,673	14,672	13,122	11,856	11,302	-1.4	-2.0
Great Lakes and Seaway	Exports	71	65	56	48*	41	35	32	-3.0	3.0
	Imports	2,135	2,130	2,127	2,127	2,123	2,119	2,117	0.0	0.0
Washington/Oregon Coast	Exports	2	2	1	1	1	1	1	-3.0	-3.0
	Imports	123	110	104	104	93	85	81	-1.3	-1.9
Columbia Snake Willamette River	Exports	15	13	12	10	9	7	7	-3.0	-3.0
	Imports	30	27	26	26	24	22	21	-1.2	1.7
California Coast	Exports	3,852	3,515	3,019	2,592	2,226	1,912	1,745	-3.0	-3.0
	Imports	1,602	1,430	1,353	1,357	1,219	1,108	1,060	-1.3	-1.9
Alaska	Exports	1,089	994	854	733	630	541	493	-3.0	-3.0
	Imports	737	737	737	737	737	737	737	0.0	0.0
Hawaii and Pacific Territories	Exports	32	29	25	21	18	16	14	-3.0	-3.0
	Imports	3,129	2,919	2,834	2,850	2,672	2,533	2,473	-0.7	-1.1
Domestic Caribbean	Exports	8	7	6	5	5	4	4	-3.0	-3.0
	Imports	6,079	5,794	5,789	5,961	5,601	5,364	5,277	-0.2	-0.9
Total	Exports	12,019	10,969	9,420	8,089	6,946	5,965	5,444	-3.0	-3.0
	Imports	93,871	83,835	79,152	79,562	71,538	65,061	62,242	-1.3	-1.9

* = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL, AND THROUGH

COMMODITY Petroleum and Coal Products
ALTERNATIVE Largergovt2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	3,124	3,206	3,276	3,398	3,555	3,708	3,796	0.6	0.9
Lower Upper Mississippi	12,091	12,323	12,291	12,668	13,225	13,934	14,429	0.4	1.0
Lower Mississippi	24,229	24,199	24,290	25,452	26,211	27,206	27,892	0.4	.7
Baton Rouge to Gulf	59,813	59,579	57,931	62,703	63,047	64,103	65,133	0.4	0.3
Illinois River	8,352	8,380	8,224	8,438	8,752	9,145	9,439	0.1	0.9
Missouri River	436	479	504	539	585	641	678	1.7	1.8
Ohio River	22,294	22,250	22,118	22,899	23,562	24,397	24,939	0.2	0.7
Tennessee River	2,121	2,113	2,265	2,485	2,675	2,889	3,032	1.2	1.5
Arkansas River	2,075	2,026	1,877	1,826	1,724	1,635	1,588	-1.0	-1.1
Gulf Coast West	89,324	88,847	79,353	84,147	84,392	85,803	87,175	-0.5	0.3
Gulf Coast East	27,929	27,304	26,546	27,101	26,840	27,159	27,523	-0.2	0.1
Warrior River System	5,475	5,578	5,680	6,043	6,246	6,526	6,720	0.8	0.8
Great Lakes	7,924	7,777	7,522	7,503	7,456	7,407	7,384	-0.4	-0.1

* - less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY Petroleum and Coal Products
ALTERNATIVE Largergovt2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	730	748	755	776	804	835	854	0.5	0.7
Lower Upper Mississippi	1,712	1,744	1,744	1,809	1,901	2,023	2,110	0.4	1.2
Lower Mississippi	12,512	12,567	12,622	13,254	13,771	14,447	14,916	0.4	0.9
Baton Rouge to Gulf	6,610	6,547	6,028	6,386	6,381	6,452	6,533	-0.3	0.2
Illinois River	1,355	1,359	1,336	1,372	1,425	1,496	1,549	0.1	0.9
Missouri River	92	101	106	114	124	135	143	1.7	1.8
Ohio River	8,414	8,354	8,173	8,471	8,659	8,949	9,157	0.1	0.6
Tennessee River	645	635	665	718	770	832	876	0.8	1.5
Arkansas River	490	481	443	428	404	384	373	-1.0	-1.0
Gulf Coast West	9,998	9,959	9,708	10,366	10,477	10,779	11,056	0.3	0.5
Gulf Coast East	2,413	2,352	2,273	2,304	2,280	2,303	2,330	-0.4	0.1
Warrior River System	223	226	232	248	257	269	278	0.8	0.9
Great Lakes	1,800	1,762	1,680	1,670	1,670	1,664	1,660	-0.6	0.0
Total	46,994	46,837	45,766	47,915	48,923	50,568	51,835	0.1	0.6

* = less than 500,000 ton-miles

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY Stone, Clay, Glass, and Concrete Products
ALTERNATIVE Largergovt2003A

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Shipped	1,372	1,412	1,609	1,591	1,589	1,676	1,744	1.1	0.7
	Received	407	419	478	472	472	498	518	1.1	0.7
Lower Upper Mississippi	Shipped	1,411	1,523	1,876	1,926	2,022	2,269	2,451	2.4	1.9
	Received	198	204	232	229	229	241	251	1.1	0.7
Lower Mississippi	Shipped	5	6	8	9	10	11	13	4.1	2.9
	Received	1,057	1,145	1,416	1,457	1,533	1,726	1,868	2.5	1.9
Baton Rouge to Gulf	Shipped	57	60	70	70	72	78	83	1.7	1.2
	Received	84	87	102	102	103	111	117	1.5	1.1
Illinois River	Shipped	68	71	84	85	87	95	100	1.8	1.3
	Received	1,095	1,173	1,430	1,460	1,523	1,696	1,825	2.2	1.7
Missouri River	Shipped	147	152	173	171	170	180	187	1.1	0.7
	Received	148	153	174	172	172	182	189	1.2	0.7
Ohio River	Shipped	1,173	1,291	1,638	1,703	1,817	2,077	2,268	2.9	2.2
	Received	1,105	1,193	1,469	1,508	1,583	1,777	1,920	2.4	1.9
Tennessee River	Shipped	19	22	31	33	37	44	50	4.5	3.2
	Received	66	68	79	79	79	84	88	1.3	0.9
Arkansas River	Shipped	3	3	5	5	6	7	8	4.9	3.4
	Received	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Shipped	246	254	290	287	287	305	318	1.2	0.8
	Received	413	435	510	513	524	569	603	1.7	1.3
Gulf Coast East	Shipped	580	679	936	1,007	1,119	1,338	1,496	4.3	3.1
	Received	592	657	844	882	946	1,091	1,195	3.1	2.4
Warrior River System	Shipped	129	134	153	152	152	162	169	1.2	0.8
	Received	216	250	341	365	403	478	533	4.1	3.0
South Atlantic Coast	Shipped	141	159	199	204	210	248	270	2.9	2.2
	Received	410	454	583	600	594	720	773	3.0	2.0
Middle Atlantic Coast	Shipped	1,938	2,144	2,755	2,836	2,810	3,404	3,655	3.0	2.0
	Received	947	1,048	1,347	1,386	1,374	1,664	1,787	3.0	2.0

4/16/80

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Shipped	17	19	25	25	25	30	33	3.0	2.0
	Received	634	700	903	929	916	1,111	1,194	3.0	1.9
Great Lakes and Seaway	Shipped	3,603	3,883	4,441	4,808	5,078	5,581	5,821	2.2	1.5
	Received	3,449	3,725	4,262	4,632	4,903	5,398	5,631	2.3	1.5
Washington/Oregon Coast	Shipped	339	437	536	548	567	648	700	2.5	1.9
	Received	255	273	331	340	350	393	422	2.2	1.7
Columbia Snake Willamette River	Shipped	25	29	37	39	43	51	57	3.6	2.8
	Received	15	17	24	25	28	33	37	4.2	2.9
California Coast	Shipped	162	184	227	233	244	285	311	2.8	2.2
	Received	33	37	46	48	49	58	63	2.9	2.2
Alaska	Shipped	6	7	9	9	9	11	12	2.9	2.1
	Received	186	209	261	268	276	327	355	2.9	2.2
Hawaii and Pacific Territories	Shipped	117	130	166	171	171	206	222	2.9	2.0
	Received	229	259	322	331	343	403	440	2.9	2.2
Domestic Caribbean	Shipped	35	35	35	35	36	36	36	0.0	0.1
	Received	116	127	147	150	158	[illegible]	192	2.0	1.9
Total	Shipped	11,655	12,633	15,303	15,948	16,560	18,742	[illegible]	2.4	1.8
	Received	11,655	12,633	15,303	15,948	16,560	18,742	[illegible]	2.4	1.8

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY Stone, Clay, Glass, and Concrete Products
ALTERNATIVE Largergovt2003A

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	82	92	109	123	136	156	170	3.1	2.6
	Imports	125	217	171	169	169	177	183	2.3	0.6
Illinois River	Exports	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	3.0	2.5
	Imports	13	19	16	16	16	16	17	1.4	0.4
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	50	57	69	78	87	100	110	3.5	2.7
	Imports	225	380	301	298	298	311	323	2.2	0.6
Gulf Coast East	Exports	37	43	51	57	64	73	80	3.3	2.6
	Imports	219	410	314	310	310	327	341	2.7	0.7
Warrior River System	Exports	19	21	25	28	31	36	39	3.1	2.6
	Imports	3	3	3	3	3	3	3	0.0	0.0
South Atlantic Coast	Exports	123	139	167	187	209	239	262	3.3	2.6
	Imports	545	957	749	741	740	777	807	2.4	0.7
Middle Atlantic Coast	Exports	316	348	410	456	505	574	626	2.9	2.5
	Imports	704	999	843	837	836	862	882	1.3	0.4

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4/16/80

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Exports	2	2	3	3	3	4	4	2.7	2.4
	Imports	12	13	12	12	12	12	12	0.0	0.0
Great Lakes and Seaway	Exports	50	69	90	107	123	148	165	6.0	3.4
	Imports	777	1,446	1,110	1,097	1,095	1,156	1,204	2.7	0.7
Washington/Oregon Coast	Exports	21	29	39	46	53	64	71	6.3	3.5
	Imports	730	1,318	1,021	1,009	1,008	1,061	1,103	2.5	0.7
Columbia-Snake Willamette River	Exports	1	1	1	1	1	1	2	2.8	2.4
	Imports	14	14	14	14	14	14	14	0.0	0.0
California Coast	Exports	36	40	47	53	59	67	73	3.1	2.5
	Imports	277	294	279	279	279	280	280	0.1	0.0
Alaska	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	79	133	106	105	105	109	113	2.2	0.6
Hawaii and Pacific Territories	Exports	a	a	a	a	a	a	1	3.1	2.6
	Imports	4	5	4	4	4	4	4	0.0	0.0
Domestic Caribbean	Exports	50	68	89	105	122	146	163	6.0	3.4
	Imports	57	88	72	71	71	74	76	1.7	0.5
Total	Exports	787	911	1,100	1,245	1,395	1,608	1,767	3.6	2.7
	Imports	3,783	6,294	5,014	4,964	4,959	5,184	5,362	2.1	0.6

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL AND THROUGH
COMMODITY Stone, Clay, Glass, and Concrete Products
ALTERNATIVE Largergovt2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	1,390	1,430	1,630	1,612	1,610	1,699	1,768	1.1	0.7
Lower Upper Mississippi	2,055	2,188	2,618	2,680	2,778	3,070	3,288	2.1	1.6
Lower Mississippi	1,343	1,440	1,758	1,794	1,872	2,086	2,244	2.3	1.7
Baton Rouge to Gulf	366	380	439	437	441	471	494	1.4	0.9
Illinois River	1,181	1,263	1,535	1,565	1,630	1,811	1,945	2.2	1.7
Missouri River	148	153	174	172	172	182	189	1.2	0.7
Ohio River	1,709	1,871	2,353	2,438	2,589	2,946	3,207	2.8	2.1
Tennessee River	82	87	105	106	110	121	130	2.0	1.6
Arkansas River	3	3	5	5	6	7	8	4.9	3.4
Gulf Coast West	436	460	540	542	554	602	639	1.7	1.1
Gulf Coast East	945	1,056	1,368	1,435	1,547	1,793	1,971	3.3	2.6
Warrior River System	343	381	491	513	551	636	698	3.2	2.4
Great Lakes	3,613	3,893	4,454	4,822	5,091	5,598	5,839	2.2	1.5

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY: Stone, Clay, Glass, and Concrete Products
ALTERNATIVE: Largergo-t2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	229	236	269	266	265	280	291	1.1	0.7
Lower Upper Mississippi	281	301	361	366	378	416	445	2.0	[illegible]
Lower Mississippi	467	496	596	605	626	590	738	2.0	1.5
Baton Rouge to Gulf	46	48	56	56	57	61	64	1.5	1.1
Illinois River	313	335	406	414	431	479	515	2.2	1.7
Missouri River	38	39	45	44	44	47	49	[illegible]	0.7
Ohio River	474	529	684	718	774	895	981	3.2	2.5
Tennessee River	33	36	43	44	46	51	55	2.2	1.7
Arkansas River	1	1	2	2	2	2	3	4.9	3.4
Gulf Coast West	46	48	56	57	58	63	66	1.7	1.2
Gulf Coast East	61	67	86	89	95	109	119	2.9	2.3
Warrior River System	11	12	16	16	17	20	22	[illegible]	2.3
Great Lakes	1,579	1,703	1,949	2,113	2,234	2,458	2,563	2.1	1.5
Total	3,582	3,852	4,568	4,790	5,028	5,570	5,913	2.3	1.6

a = less than 500,000 ton-miles

4/17/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY Primary Metals Products
ALTERNATIVE Largergovt2003A

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Shipped	62	63	64	65	66	67	68	0.3	0.4
	Received	294	292	341	369	390	423	443	1.8	1.4
Lower Upper Mississippi	Shipped	180	184	205	220	235	259	274	1.6	1.7
	Received	510	508	599	654	696	761	803	1.9	1.6
Lower Mississippi	Shipped	37	37	39	41	42	44	46	0.8	0.9
	Received	538	527	649	715	762	833	876	2.2	1.6
Baton Rouge to Gulf	Shipped	2,596	2,546	3,322	3,767	4,097	4,552	4,835	2.9	1.9
	Received	386	397	386	393	405	426	440	0.1	0.9
Illinois River	Shipped	813	825	883	928	969	1,035	1,077	1.0	1.2
	Received	1,126	1,118	1,298	1,403	1,483	1,596	1,667	1.7	1.3
Missouri River	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	77	75	92	101	106	115	120	2.0	1.4
Ohio River	Shipped	1,998	2,043	2,295	2,478	2,644	2,908	3,080	1.7	1.7
	Received	1,980	2,024	2,425	2,703	2,945	3,290	3,513	2.4	2.0
Tennessee River	Shipped	149	149	152	154	156	159	161	0.3	0.3
	Received	333	340	390	425	456	502	532	1.9	1.7
Arkansas River	Shipped	4	4	5	5	5	5	5	0.6	0.8
	Received	340	334	399	433	458	495	518	1.9	1.4
Gulf Coast West	Shipped	797	805	844	874	901	944	972	0.7	0.8
	Received	1,507	1,530	1,716	1,843	1,955	2,129	2,241	1.6	1.5
Gulf Coast East	Shipped	107	116	139	161	182	211	231	3.2	2.8
	Received	58	58	67	73	78	85	90	1.8	1.6
Warrior River System	Shipped	104	105	112	117	122	129	134	0.9	1.0
	Received	167	163	191	205	215	228	235	1.8	1.1
South Atlantic Coast	Shipped	125	125	125	125	125	125	125	0.0	0.0
	Received	76	76	76	76	76	76	76	0.0	0.0
Middle Atlantic Coast	Shipped	614	584	573	561	550	538	531	-0.7	-0.4
	Received	553	468	456	445	433	422	415	-1.7	-0.5

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SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Shipped	13	13	13	13	13	13	13	0.0	0.0
	Received	4	4	4	4	4	4	4	0.0	0.0
Great Lakes and Seaway	Shipped	1,246	1,262	1,322	1,371	1,418	1,492	1,541	0.7	0.9
	Received	758	754	808	838	860	892	912	0.8	0.7
Washington/Oregon Coast	Shipped	173	79	79	79	79	79	79	-5.8	0.0
	Received	36	20	20	20	20	20	20	-4.4	0.0
Columbia Snake Willamette River	Shipped	11	10	10	10	10	10	10	-1.0	0.0
	Received	1	0	0	0	0	0	0	100.0	0.0
California Coast	Shipped	70	70	70	70	70	70	70	0.0	0.0
	Received	32	8	8	8	8	8	8	-9.9	0.0
Alaska	Shipped	4	4	4	4	4	4	4	-1.6	0.0
	Received	63	63	63	63	63	63	63	0.0	0.0
Hawaii and Pacific Territories	Shipped	12	11	11	11	11	11	11	-0.3	0.0
	Received	96	96	96	96	96	96	96	0.0	0.0
Domestic Caribbean	Shipped	12	12	12	12	12	12	12	0.0	0.0
	Received	191	192	196	198	201	205	208	0.3	0.4
Total	Shipped	9,127	9,049	10,280	11,066	11,711	12,669	13,281	1.5	1.4
	Received	9,127	9,049	10,280	11,066	11,711	12,669	13,281	1.5	1.4

* - less than 500 tons

4/17/80

WATERBORNE DEMAND PROJECTIONS (1000 S TONS)
FOREIGN TRADE

COMMODITY Primary Metals Products
ALTERNATIVE [illegible]

SEGMENT	EXP/IMP	1977	1980	1985	1990	1995	2000	[illegible]	% GROWTH [illegible]	[illegible]
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	321	307	320	313	318	332	312	[illegible]	[illegible]
	Imports	3,623	3,755	5,124	5,811	6,339	[illegible]	[illegible]	[illegible]	[illegible]
Illinois River	Exports	139	178	171	170	170	172	174	1.6	0.2
	Imports	1,909	1,241	1,662	1,784	1,846	1,942	1,990	0.5	0.8
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	328	317	266	259	265	280	[illegible]	[illegible]	[illegible]
	Imports	2,547	2,331	3,108	3,457	3,644	3,935	[illegible]	2.4	[illegible]
Gulf Coast East	Exports	109	105	84	82	83	90	94	2.2	1.1
	Imports	324	312	405	459	496	546	[illegible]	2.7	1.8
Warrior River System	Exports	67	64	52	50	52	55	59	2.2	1.1
	Imports	201	187	252	281	304	332	[illegible]	2.7	1.6
South Atlantic Coast	Exports	240	272	211	227	231	243	251	[illegible]	[illegible]
	Imports	902	774	1,013	1,115	1,165	1,216	1,272	1.6	1.0
Middle Atlantic Coast	Exports	1,036	1,195	1,067	1,019	1,063	1,100	[illegible]	[illegible]	[illegible]
	Imports	3,648	4,175	5,760	6,226	6,516	7,048	[illegible]	4.2	[illegible]

Page [illegible]

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SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic	Exports	22	23	22	22	22	22	22	0.1	0.2
Coast	Imports	752	659	891	991	1,041	1,121	1,166	2.1	1.3
Great Lakes and	Exports	256	344	321	320	322	328	333	1.7	0.3
Seaway	Imports	4,841	4,664	6,392	6,679	6,902	7,251	7,423	2.5	0.8
Washington/Oregon	Exports	72	80	76	75	76	77	78	0.4	0.2
Coast	Imports	307	305	410	456	481	518	539	3.1	1.3
Columbia-Snake	Exports	18	22	20	20	20	20	21	0.6	0.4
Willamette River	Imports	501	491	648	713	743	784	803	2.8	0.9
California Coast	Exports	117	175	146	142	145	154	160	1.5	0.9
	Imports	2,597	2,561	3,401	3,764	3,944	4,202	4,334	2.9	1.1
Alaska	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	19	20	26	28	28	28	28	2.8	0.2
Hawaii and Pacific	Exports	a	a	a	a	a	a	a	-0.9	0.8
Territories	Imports	74	78	99	105	106	108	108	2.8	0.2
Domestic Caribbean	Exports	12	13	11	11	11	12	12	-1.0	0.8
	Imports	173	182	234	250	253	259	261	2.9	0.3
Total	Exports	2,788	3,155	2,791	2,741	2,779	2,887	2,964	-0.1	0.6
	Imports	22,412	21,736	29,428	32,123	33,836	36,380	37,811	2.8	1.3

a - less than 500 tons

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WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL, AND THROUGH
COMMODITY Primary Metals Products
ALTERNATIVE Largergovt2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	356	355	404	433	456	490	512	1.5	1.3
Lower Upper Mississippi	2,689	2,699	3,184	3,488	3,735	4,107	4,344	2.0	1.7
Lower Mississippi	4,214	4,228	5,134	5,705	6,166	6,831	7,253	2.4	1.9
Baton Rouge to Gulf	4,060	4,054	4,965	5,527	5,972	6,608	7,009	2.4	1.8
Illinois River	2,410	2,427	2,779	3,008	3,198	3,483	3,665	1.7	1.5
Missouri River	77	75	92	101	106	115	120	2.0	1.4
Ohio River	3,518	3,598	4,202	4,627	5,005	5,560	5,920	2.1	1.9
Tennessee River	479	486	539	577	610	659	691	1.4	1.4
Arkansas River	342	336	401	436	461	498	521	1.9	1.4
Gulf Coast West	1,752	1,778	1,976	2,113	2,235	2,424	2,546	1.5	1.4
Gulf Coast East	314	320	385	429	468	522	557	2.4	2.0
Warrior River System	227	224	259	279	293	313	326	1.6	1.2
Great Lakes	1,457	1,469	1,583	1,662	1,731	1,838	1,906	1.0	1.1

a - less than 500 tons

4/17/80

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY: Primary Metals Products
ALTERNATIVE: Largergovt2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	179	178	203	218	229	246	257	1.5	1.3
Lower Upper Mississippi	526	528	626	687	736	811	858	2.1	1.7
Lower Mississippi	2,554	2,569	3,125	3,481	3,771	4,189	4,455	2.4	1.9
Baton Rouge to Gulf	636	625	771	854	915	1,003	1,058	2.3	1.7
Illinois River	442	447	515	560	599	657	694	1.8	1.7
Missouri River	30	30	36	40	42	45	47	2.0	1.4
Ohio River	2,160	2,233	2,627	2,921	3,190	3,584	3,841	2.3	2.1
Tennessee River	120	121	140	152	163	179	190	1.9	1.7
Arkansas River	106	104	124	134	142	154	161	1.9	1.4
Gulf Coast West	323	330	374	405	432	475	503	1.7	1.7
Gulf Coast East	26	26	31	34	37	40	42	2.0	1.5
Warrior River System	35	34	38	40	41	43	45	1.1	0.9
Great Lakes	266	266	266	268	266	266	266	0.0	0.0
Total	7,403	7,491	8,876	9,792	10,564	11,693	12,417	2.2	1.8

a = less than 500,000 ton-miles

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY Waste and Scrap
ALTERNATIVE Largergovt2003A

SEGMENT	IN/OUT	YEARS 1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Shipped	33	36	41	45	44	44	44	2.5	0.1
	Received	2	2	2	2	2	2	2	1.9	0.5
Lower Upper Mississippi	Shipped	68	71	81	90	91	93	95	2.2	0.4
	Received	134	143	158	170	164	163	165	1.8	0.2
Lower Mississippi	Shipped	72	77	90	100	99	99	101	2.5	0.1
	Received	38	33	29	25	21	19	18	3.3	2.6
Baton Rouge to Gulf	Shipped	139	135	134	133	123	116	114	0.3	1.2
	Received	111	102	99	95	89	85	84	1.2	0.9
Illinois River	Shipped	985	928	983	854	789	747	736	1.1	1.1
	Received	795	729	657	608	550	512	493	2.0	1.5
Missouri River	Shipped	0	0	0	0	0	0	0	0.0	0.0
	Received	8	37	74	110	111	111	111	22.2	0.1
Ohio River	Shipped	241	253	299	338	354	360	370	2.6	0.7
	Received	276	275	313	344	365	371	380	1.7	0.8
Tennessee River	Shipped	56	55	58	60	59	58	58	0.5	0.3
	Received	38	37	44	48	49	50	51	1.8	0.5
Arkansas River	Shipped	20	21	26	29	29	30	30	3.0	0.3
	Received	1	1	2	2	2	2	2	1.9	0.5
Gulf Coast West	Shipped	830	721	580	468	378	308	274	4.3	4.0
	Received	1,354	1,258	1,175	1,094	956	862	830	1.6	2.1
Gulf Coast East	Shipped	67	69	78	82	77	75	76	1.6	0.6
	Received	14	14	15	16	15	14	14	0.8	0.9
Warrior River System	Shipped	374	390	447	478	448	435	438	1.9	0.7
	Received	25	26	29	31	30	29	29	1.9	0.7
South Atlantic Coast	Shipped	32	34	40	41	41	40	40	1.9	0.3
	Received	55	57	65	70	65	64	64	1.9	0.7
Middle Atlantic Coast	Shipped	9,057	9,130	9,377	9,380	9,404	9,385	9,357	0.3	0.0
	Received	9,101	9,184	9,469	9,467	9,501	9,480	9,446	0.3	0.0

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SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2001	% GROWTH 77-90	90-01
North Atlantic Coast	Shipped	54	64	97	97	100	98	94	4.5	0.2
	Received	7	7	7	7	7	7	7	0.0	0.0
Great Lakes and Seaway	Shipped	116	121	135	147	150	154	158	1.8	0.5
	Received	204	217	250	279	287	297	307	2.4	0.7
Washington/Oregon Coast	Shipped	1,816	1,754	1,612	1,555	1,487	1,435	1,110	1.3	0.7
	Received	1,871	1,790	1,678	1,591	1,523	1,471	1,446	1.2	0.7
Columbia Snake Willamette River	Shipped	59	50	39	30	21	18	16	4.9	4.9
	Received	59	51	39	31	24	19	16	4.9	4.8
California Coast	Shipped	12	12	14	14	14	14	14	1.2	0.1
	Received	26	26	26	26	26	26	26	0.0	0.0
Alaska	Shipped	26	26	26	26	26	26	26	0.0	0.0
	Received	2	2	2	2	2	2	2	0.0	0.0
Hawaii and Pacific Territories	Shipped	34	34	34	34	34	34	34	0.0	0.0
	Received	8	8	8	8	8	8	8	0.0	0.0
Domestic Caribbean	Shipped	221	226	230	230	230	230	229	0.1	0.0
	Received	202	205	205	205	205	205	205	0.1	0.0
Total	Shipped	14,333	14,207	14,348	14,231	14,001	13,798	13,714	0.1	0.1
	Received	14,333	14,207	14,348	14,231	14,001	13,798	13,714	0.1	0.1

a = less than 500 tons

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WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY Waste and Scrap
ALTERNATIVE Largorgovt2003A

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Baton Rouge to Gulf	Exports	265	351	443	448	453	460	465	4.1	0.3
	Imports	166	207	260	327	398	507	587	5.4	4.6
Illinois River	Exports	16	21	27	27	27	27	27	4.1	0.2
	Imports	7	8	11	13	16	21	24	5.4	4.6
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	100	127	162	173	184	199	211	4.3	1.6
	Imports	71	89	111	140	170	217	251	5.4	4.6
Gulf Coast East	Exports	142	186	235	241	248	257	263	4.2	0.7
	Imports	2	3	4	5	6	7	8	5.3	4.6
Warrior River System	Exports	43	57	72	73	75	77	79	4.2	0.6
	Imports	0	0	0	0	0	0	0	0.0	0.0
South Atlantic Coast	Exports	275	337	422	449	475	512	538	3.8	1.4
	Imports	54	65	79	97	115	144	165	4.5	4.2
Middle Atlantic Coast	Exports	2,237	2,904	3,655	3,733	3,808	3,910	3,983	4.0	0.5
	Imports	141	171	210	259	310	389	447	4.8	4.3

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SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Exports	975	1,286	1,622	1,640	1,659	1,683	1,699	4.1	0.3
	Imports	9	10	10	10	10	10	10	0.1	0.1
Great Lakes and Seaway	Exports	288	382	482	485	489	493	495	4.1	0.2
	Imports	96	120	150	189	230	294	340	5.4	4.6
Washington/Oregon Coast	Exports	240	304	395	438	486	552	602	4.7	2.5
	Imports	29	37	46	57	70	89	102	5.3	4.6
Columbia-Snake Willamette River	Exports	200	262	333	344	357	373	386	4.3	0.9
	Imports	a	a	a	a	a	a	a	2.1	2.4
California Coast	Exports	1,940	2,523	3,226	3,395	3,580	3,836	4,028	4.4	1.3
	Imports	50	60	72	88	105	131	150	4.5	4.2
Alaska	Exports	a	a	a	a	a	a	a	4.1	0.2
	Imports	7	7	7	7	7	7	7	0.1	0.0
Hawaii and Pacific Territories	Exports	32	39	50	56	63	72	79	4.5	2.7
	Imports	a	a	a	a	a	a	a	0.1	0.0
Domestic Caribbean	Exports	69	82	106	122	138	161	179	4.5	3.0
	Imports	1	2	2	3	3	4	5	5.0	4.4
Total	Exports	6,817	8,860	11,229	11,625	12,041	12,614	13,036	4.2	0.9
	Imports	634	779	962	1,196	1,439	1,820	2,097	5.0	4.4

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC - INBOUND, OUTBOUND, LOCAL, AND THROUGH
COMMODITY: Waste and Scrap
ALTERNATIVE: Largergovt2003A

SEGMENT	1977	1980	1985	1990	1995	2000	2003	% GROWTH 77-90	% GROWTH 90-03
Upper Mississippi	34	37	43	47	46	46	46	2.5	0.1
Lower Upper Mississippi	436	476	557	628	621	623	633	2.8	0.1
Lower Mississippi	325	325	348	364	351	344	346	0.9	-0.4
Baton Rouge to Gulf	390	373	372	368	340	323	320	-0.4	1.1
Illinois River	1,129	1,082	1,066	1,052	1,004	970	967	0.5	-0.7
Missouri River	8	37	74	110	111	111	111	22.2	0.1
Ohio River	397	408	474	528	549	557	571	2.2	0.6
Tennessee River	94	92	102	108	108	108	109	1.1	0.1
Arkansas River	20	21	26	29	29	30	30	3.0	0.3
Gulf Coast West	1,430	1,327	1,242	1,157	1,014	918	884	-1.6	2.0
Gulf Coast East	434	452	515	550	515	500	503	1.8	0.7
Warrior River System	381	397	455	487	456	443	446	1.9	0.7
Great Lakes	242	257	297	332	341	353	365	2.5	0.7

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON-MILES
MISSISSIPPI RIVER SYSTEM-GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY Waste and Scrap
ALTERNATIVE Largergov12003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	16	18	20	22	22	22	22	2.5	0.1
Lower Upper Mississippi	70	73	84	92	91	91	92	2.1	0.0
Lower Mississippi	177	177	189	198	190	186	188	0.8	-0.4
Baton Rouge to Gulf	53	51	52	52	49	47	46	0.2	-0.9
Illinois River	214	208	210	214	205	200	201	0.0	0.5
Missouri River	3	14	27	40	40	41	41	22.2	0.1
Ohio River	262	268	312	349	367	374	385	2.2	0.8
Tennessee River	18	19	22	25	25	26	27	2.7	0.6
Arkansas River	5	6	7	8	8	8	8	3.1	0.3
Gulf Coast West	275	271	283	287	262	248	246	0.3	1.2
Gulf Coast East	51	53	61	65	61	58	60	1.9	-0.7
Warrior River System	136	142	162	174	163	158	159	1.9	0.7
Great Lakes	48	51	59	66	68	70	73	2.5	0.8
Total	1,329	1,350	1,489	1,591	1,551	1,531	1,547	1.4	0.2

a = less than 500,000 ton-miles

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
DOMESTIC TRAFFIC

COMMODITY Other Commodities
ALTERNATIVE Largergovt2003A

SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Shipped	37	37	38	39	41	42	43	0.5	0.7
	Received	151	151	152	153	154	156	158	0.1	0.2
Lower Upper Mississippi	Shipped	1,139	1,141	1,149	1,158	1,166	1,177	1,185	0.1	0.2
	Received	529	533	543	555	567	582	593	0.4	0.5
Lower Mississippi	Shipped	1,210	1,214	1,224	1,236	1,247	1,262	1,272	0.2	0.2
	Received	3,193	3,196	3,204	3,213	3,222	3,234	3,243	0.0	0.1
Baton Rouge to Gulf	Shipped	1,202	1,274	1,474	1,706	1,925	2,218	2,427	2.7	2.7
	Received	3,804	3,836	3,969	4,136	4,293	4,526	4,699	0.6	1.0
Illinois River	Shipped	22	24	29	36	41	49	55	3.7	3.4
	Received	55	60	73	89	103	122	136	3.7	3.4
Missouri River	Shipped	327	327	328	328	328	329	329	0.0	0.0
	Received	329	330	331	332	333	334	335	0.1	0.1
Ohio River	Shipped	1,880	1,894	1,932	1,977	2,016	2,074	2,114	0.4	0.5
	Received	506	519	554	594	632	683	720	1.2	1.5
Tennessee River	Shipped	1,572	1,576	1,587	1,598	1,610	1,625	1,636	0.1	0.2
	Received	82	88	103	122	139	162	179	3.1	3.0
Arkansas River	Shipped	634	635	636	639	641	643	645	0.1	0.1
	Received	692	693	697	701	705	711	715	0.1	0.1
Gulf Coast West	Shipped	10,391	10,670	11,627	12,788	13,878	15,434	16,570	1.6	2.0
	Received	11,821	12,058	12,946	14,039	15,066	16,561	17,663	1.3	1.8
Gulf Coast East	Shipped	5,648	5,526	5,353	5,198	5,054	4,954	4,915	-0.6	-0.4
	Received	2,608	2,561	2,506	2,463	2,423	2,409	2,414	-0.4	-0.2
Warrior River System	Shipped	1,195	1,162	1,111	1,064	1,019	979	957	-0.9	-0.8
	Received	1,426	1,387	1,325	1,268	1,213	1,163	1,136	-0.9	-0.8
South Atlantic Coast	Shipped	646	746	916	1,086	1,264	1,520	1,721	4.1	3.6
	Received	413	478	586	695	809	973	1,101	4.1	3.6
Middle Atlantic Coast	Shipped	2,830	3,204	3,837	4,469	5,134	6,099	6,860	3.6	3.4
	Received	2,461	2,777	3,312	3,848	4,410	5,229	5,874	3.5	3.3

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SEGMENT	IN/OUT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Shipped	284	328	402	477	555	668	756	4.1	3.6
	Received	339	392	481	570	663	798	903	4.1	3.6
Great Lakes and Seaway	Shipped	247	255	300	327	348	385	414	2.2	1.8
	Received	254	263	309	338	360	399	430	2.2	1.9
Washington/Oregon Coast	Shipped	763	880	1,080	1,281	1,490	1,792	2,028	4.1	3.6
	Received	249	286	350	416	484	582	658	4.0	3.6
Columbia-Snake Willamette River	Shipped	68	76	93	111	129	154	173	3.8	3.5
	Received	49	54	66	79	92	110	122	3.8	3.4
California Coast	Shipped	1,482	1,709	2,095	2,480	2,884	3,466	3,923	4.0	3.6
	Received	1,051	1,212	1,485	1,757	2,042	2,453	2,776	4.0	3.6
Alaska	Shipped	243	280	344	408	475	571	646	4.1	3.6
	Received	735	849	1,042	1,235	1,437	1,728	1,957	4.1	3.6
Hawaii and Pacific Territories	Shipped	1,025	1,184	1,454	1,723	2,005	2,411	2,731	4.1	3.6
	Received	1,595	1,844	2,263	2,682	3,121	3,754	4,251	4.1	3.6
Domestic Caribbean	Shipped	476	519	607	696	791	926	1,032	3.0	3.1
	Received	979	1,099	1,320	1,541	1,774	2,108	2,371	3.6	3.4
Total	Shipped	33,321	34,663	37,617	40,826	44,042	48,778	52,433	1.6	1.9
	Received	33,321	34,663	37,617	40,826	44,042	48,778	52,433	1.6	1.9

* = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
FOREIGN TRADE

COMMODITY Other Commodities
ALTERNATIVE Largergovt2003A

SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Upper Mississippi	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Lower Mississippi	Exports	0	0	0	0	0	0	0	[illegible]	[illegible]
	Imports	0	0	0	0	0	0	0	0.0	[illegible]
Baton Rouge to Gulf	Exports	490	572	813	1,039	1,252	1,596	1,87[illegible]	5.9	4.6
	Imports	522	550	616	670	689	71[illegible]	[illegible]	1.9	0.6
Illinois River	Exports	23	26	38	48	58	74	8[illegible]	5.9	4.6
	Imports	57	60	66	72	74	78	80	1.8	0.8
Missouri River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Ohio River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Tennessee River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Arkansas River	Exports	0	0	0	0	0	0	0	0.0	0.0
	Imports	0	0	0	0	0	0	0	0.0	0.0
Gulf Coast West	Exports	788	919	1,306	1,668	2,012	2,564	3,[illegible]08	5.9	4.6
	Imports	727	765	858	933	959	991	1,014	1.9	0.6
Gulf Coast East	Exports	24	28	40	51	62	79	92	5.9	4.6
	Imports	91	95	107	116	119	124	126	1.9	0.6
Warrior River System	Exports	45	52	74	95	114	146	171	5.9	4.6
	Imports	47	49	55	60	62	64	65	1.9	0.6
South Atlantic Coast	Exports	1,041	1,214	1,726	2,204	2,658	3,387	3,974	5.9	4.6
	Imports	1,167	1,228	1,374	1,492	1,527	1,572	1,598	1.9	0.5
Middle Atlantic Coast	Exports	3,270	3,816	5,421	6,927	8,351	10,643	12,488	5.9	4.6
	Imports	4,367	4,593	5,141	5,580	5,710	5,879	5,927	1.9	0.5

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SEGMENT	EXP/IMP	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
North Atlantic Coast	Exports	45	53	75	96	116	148	174	5.9	4.6
	Imports	485	510	571	620	634	653	664	1.9	0.5
Great Lakes and Seaway	Exports	123	144	205	262	315	402	471	5.9	4.6
	Imports	257	269	299	324*	334	349	361	1.8	0.8
Washington/Oregon Coast	Exports	100	116	165	211	255	324	381	5.9	4.6
	Imports	1,496	1,740	2,322	3,041	3,815	4,924	5,817	5.6	5.1
Columbia Snake Willamette River	Exports	25	30	42	54	65	83	97	5.9	4.6
	Imports	408	475	634	830	1,041	1,344	1,588	5.6	5.1
California Coast	Exports	607	708	1,006	1,285	1,550	1,975	2,317	5.9	4.6
	Imports	3,717	4,324	5,770	7,556	9,479	12,234	14,452	5.6	5.1
Alaska	Exports	20	24	34	43	52	66	77	5.9	4.6
	Imports	137	152	188	229	267	321	364	4.0	3.6
Hawaii and Pacific Territories	Exports	11	13	18	23	28	35	42	5.9	4.6
	Imports	69	76	94	115	134	161	183	4.0	3.6
Domestic Caribbean	Exports	67	79	112	143	172	219	257	5.9	4.6
	Imports	291	323	399	485	566	681	772	4.0	3.6
Total	Exports	6,679	7,794	11,077	14,149	17,058	21,741	25,509	5.9	4.6
	Imports	13,839	15,210	18,495	22,124	25,409	30,089	33,789	3.7	3.3

* = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS (1000'S TONS)
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC INBOUND, OUTBOUND, LOCAL, AND THROUGH
COMMODITY Other Commodities
ALTERNATIVE largergovt2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	153	154	155	157	159	162	164	0.2	0.3
Lower Upper Mississippi	1,253	1,264	1,295	1,331	1,364	1,410	1,442	0.5	0.6
Lower Mississippi	4,890	4,914	4,980	5,057	5,130	5,229	5,299	0.3	0.4
Baton Rouge to Gulf	4,143	4,194	4,381	4,611	4,827	5,140	5,370	0.8	1.2
Illinois River	83	90	110	133	154	183	204	3.7	3.4
Missouri River	330	331	332	333	335	336	337	0.1	0.1
Ohio River	3,509	3,533	3,599	3,675	3,746	3,843	3,911	0.4	0.5
Tennessee River	1,632	1,641	1,665	1,693	1,720	1,756	1,781	0.3	0.4
Arkansas River	699	701	707	713	719	727	733	0.1	0.2
Gulf Coast West	12,230	12,474	13,381	14,497	15,547	17,079	18,210	1.3	1.8
Gulf Coast East	6,036	5,914	5,745	5,599	5,462	5,378	5,352	-0.6	-0.3
Warrior River System	1,597	1,555	1,491	1,432	1,376	1,327	1,300	-0.8	-0.7
Great Lakes	261	271	318	350	374	416	448	2.3	1.9

a = less than 500 tons

4/16/80

WATERBORNE DEMAND PROJECTIONS
MILLIONS OF TON-MILES
MISSISSIPPI RIVER SYSTEM/GREAT LAKES
DOMESTIC TRAFFIC

COMMODITY Other Commodities
ALTERNATIVE Largergovt2003A

SEGMENT	1977	1980	1985	YEARS 1990	1995	2000	2003	% GROWTH 77-90	90-03
Upper Mississippi	14	15	15	15	15	15	16	0.2	0.3
Lower Upper Mississippi	112	113	118	124	129	136	141	0.8	1.0
Lower Mississippi	1,693	1,707	1,745	1,789	1,830	1,887	1,927	0.4	0.6
Baton Rouge to Gulf	393	396	406	419	432	450	464	0.5	0.8
Illinois River	12	13	15	18	21	25	28	3.7	3.4
Missouri River	40	40	41	41	41	42	42	0.1	0.2
Ohio River	231	238	257	280	302	331	351	1.5	1.8
Tennessee River	92	93	97	102	108	111	115	0.8	1.0
Arkansas River	48	48	49	49	50	50	51	0.2	0.2
Gulf Coast West	1,001	999	1,019	1,050	1,079	1,131	1,172	0.4	0.8
Gulf Coast East	269	264	258	253	248	245	245	0.5	-0.2
Warrior River System	34	33	32	31	30	29	29	-0.7	-0.6
Great Lakes	71	73	86	95	103	115	124	2.3	2.0
Total	4,010	4,033	4,139	4,267	4,385	4,567	4,704	0.5	0.8

* = less than 500,000 ton-miles

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